Aviation Week

Including Space Technology

75 cents

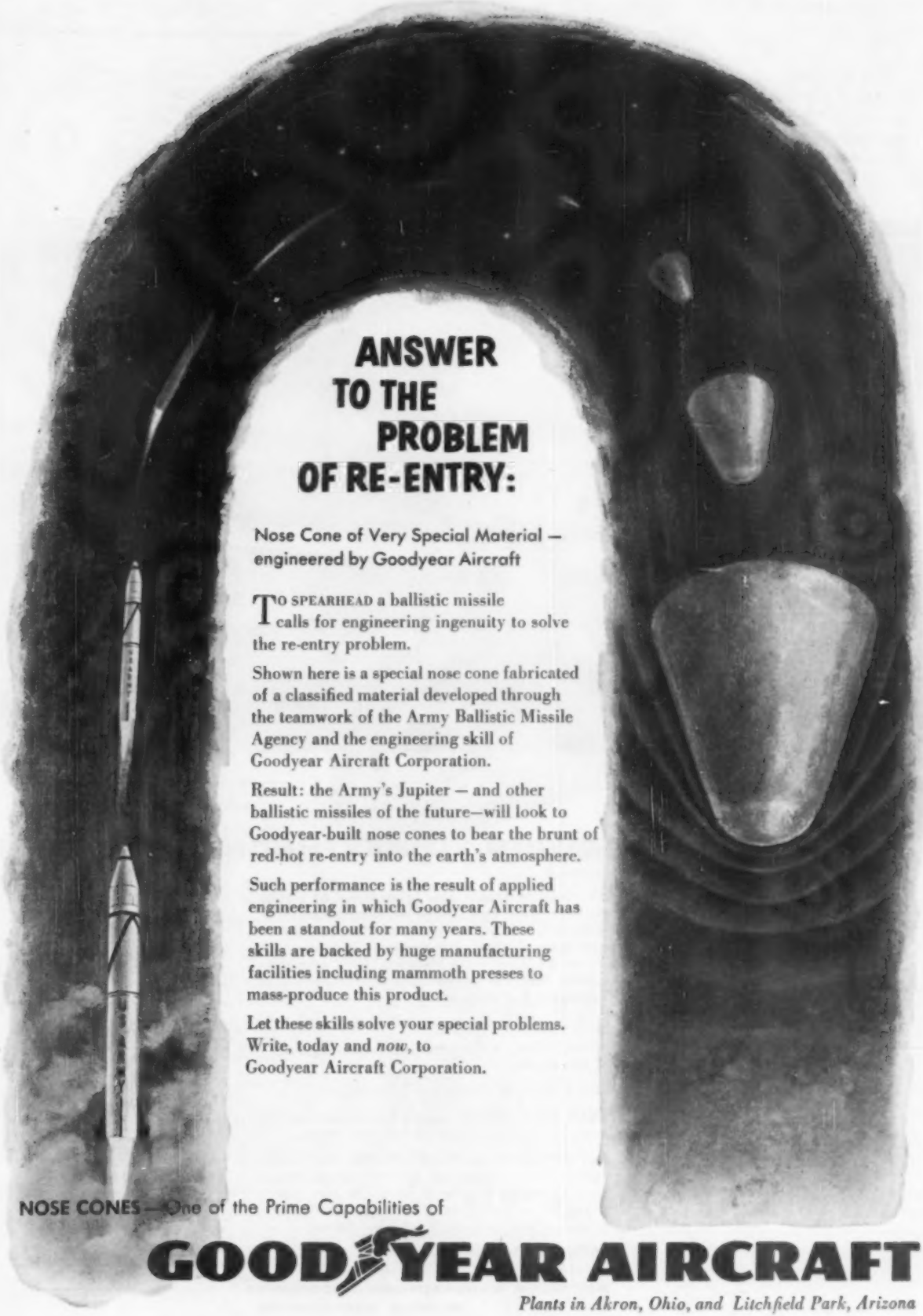
A McGraw-Hill Publication

August 18, 1958

Soviets Report Space Details

CAA Forecasts Avionic Outlays

Vertol 76 Turboprop VTOL



ANSWER TO THE PROBLEM OF RE-ENTRY:

Nose Cone of Very Special Material — engineered by Goodyear Aircraft

TO SPEARHEAD a ballistic missile calls for engineering ingenuity to solve the re-entry problem.

Shown here is a special nose cone fabricated of a classified material developed through the teamwork of the Army Ballistic Missile Agency and the engineering skill of Goodyear Aircraft Corporation.

Result: the Army's Jupiter — and other ballistic missiles of the future—will look to Goodyear-built nose cones to bear the brunt of red-hot re-entry into the earth's atmosphere.

Such performance is the result of applied engineering in which Goodyear Aircraft has been a standout for many years. These skills are backed by huge manufacturing facilities including mammoth presses to mass-produce this product.

Let these skills solve your special problems. Write, today and *now*, to Goodyear Aircraft Corporation.

NOSE CONES—One of the Prime Capabilities of

GOODYEAR AIRCRAFT

Plants in Akron, Ohio, and Litchfield Park, Arizona

requires no wrench clearance...

IT'S THE "LITTLEST" SELF-LOCKING NUT... ...IN THE WORLD!

Another "first" by Kaynar—originator of every major improvement in self-locking nuts in the last 20 years!

We eliminated conventional hex nut wrenching surfaces to give you the Kaylock H50, a *two-point* miniature self-locking nut that enables you to reduce your present space dimensions as much as one-third! H50 self-locking nuts are installed by wrenching on the *threaded nut element itself* with standard spin-type or socket wrenches *3 to 4 sizes smaller* than required by standard hex nuts.

And because the wrench never touches the mounting surface, troublesome scratching and damage is eliminated.

Your Kaylock consultant can point out limitless applications in which the H50 offers definite advantages.

Available in thread sizes 4-40, 6-32 and 8-32.

KAYLOCK.

all-metal self-locking nuts

Pat. No. 2,816,591

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Los Angeles, Calif.—Wichita, Kansas—New York, New York

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Get the original - by Kaylock

AVIATION CALENDAR

Aug. 25-27—Third Annual Convention, National Flying Club Assn., Hollywood Roosevelt Hotel, Hollywood, Calif.

Aug. 25-29—Second Symposium on Naval Hydrodynamics, Washington, D. C.

Aug. 25-31—1958 Texas and Southwestern Soaring Contest, Grand Prairie, Tex.

Aug. 30-Sept. 1—Annual One-Design Sailplane Regatta, Harris Hill, Elmira, N. Y.

Aug. 31-Sept 1—Air Race, Professional Race Pilots Assn., Ft. Wayne, Ind. For details: Don Berliner, 18 Hudson Ave., Athens, Ohio.

Sept. 1-7—1958 Farnborough Flying Display and Exhibition, Society of British Aircraft Constructors, Farnborough, Eng.

Sept. 2-12—Problems of High-Powered Radar Design, Summer Program, Massachusetts Institute of Technology, Cambridge, Mass. (Security clearance required.)

Sept. 3-5—1958 Cryogenic Engineering Conference, Massachusetts Institute of Technology, Cambridge, Mass.

Sept. 4-6—AGARD Avionics Panel Meeting, Cambridge University, Cambridge, England.

Sept. 8-13—First International Congress of the Aeronautical Sciences, Palace Hotel, Madrid, Spain.

Sept. 9-11—Second National Conference on Applied Meteorology: Engineering, Ann Arbor, Mich. Program Chairman: Dr. D. J. Portman, 5500 East Engineering Bldg., University of Michigan, Ann Arbor, Mich.

Sept. 11-12—Annual Business Meeting and Conference, Northeast Chapter, American Assn. of Airport Executives, Municipal Airport, Worcester, Mass.

Sept. 15-18—Fall Meeting, American Rocket Society, Inc., Hotel Statler, Detroit.

Sept. 15-19—Annual Instrument-Automation Conference & Exhibit (International), In-

(Continued on page 5)

AVIATION WEEK Including Space Technology

August 18, 1958

Vol. 69, No. 7

Published weekly with an additional issue in December by McGraw-Hill Publishing Company. James H. McGraw (1860-1948), Founder. See panel below for directions regarding subscription or change of address. **Executive, Editorial, Circulation and Advertising Offices: McGraw-Hill Building, 330 West 42nd Street, New York 36, N. Y.** Publication Offices, 99-129 North Broadway, Albany 1, N. Y. Donald C. McGraw, President; Joseph A. Gerardi, Executive Vice President; L. Keith Goodrich, Vice President and Treasurer; John J. Cooke, Secretary; Nelson Bond, Executive Vice President, Publications Division; Ralph B. Smith, Vice President and Editorial Director; Joseph H. Allen, Vice President and Director of Advertising Sales; A. R. Venezian, Vice President and Circulation Coordinator.

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Single copies 75¢. Subscription rates—United States and possessions, $7 one year. Canada $8 one year. All other countries, $20 one year.

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Progress in the Science of Chronometry

IN 1714, the British government offered a prize of £20,000 for any means of determining a ship's longitude within 30 nautical miles at the end of a six week's voyage. John Harrison, a self-educated Yorkshire carpenter, won the prize in 1760 with an accurate clock.

IN 1958, ICBMs and earth satellites created the need for new concepts in accurate timing. To fill this need, Hycon Eastern has developed an electronic Timing System with heretofore unattainable timing precision capable of operating anywhere in the world.

AN INTEGRATED TIMING SYSTEM FOR TODAY'S GLOBAL CONCEPTS

WESCON SHOW
Booth Nos. 1565 & 1566

Solar or sidereal time is displayed visually and is available for input to automatic computers and indexing data with many types of recorders . . . magnetic tape, oscillograms, photographs and strip charts. Furnishing a time scale with resolutions available to one microsecond, this system is ideally suited for tracking and control of missiles, astronomical measurements, and navigation systems. Write for Bulletin TS-00.

HYCON EASTERN, INC.

75 Cambridge Parkway Dept. W Cambridge 42, Massachusetts

NEWEST ADDITION TO RAYTHEON "CITY"

Increases company's engineering space to 903,000 sq. ft.

Raytheon's brand new laboratory at Santa Barbara, California, is devoted to advanced engineering in radar, countermeasures, communications, infrared. It's another extension of Raytheon "City"—the booming electronics community that has grown from Massachusetts to Tennessee to California.

Here are the company's vital statistics:

POPULATION: 3,000 scientists and engineers; 31,000 employees in all.

BUILDINGS: 26 plants and laboratories.

WORK AREA: 903,000 square feet of engineering space; 4,104,827 square feet of total space.

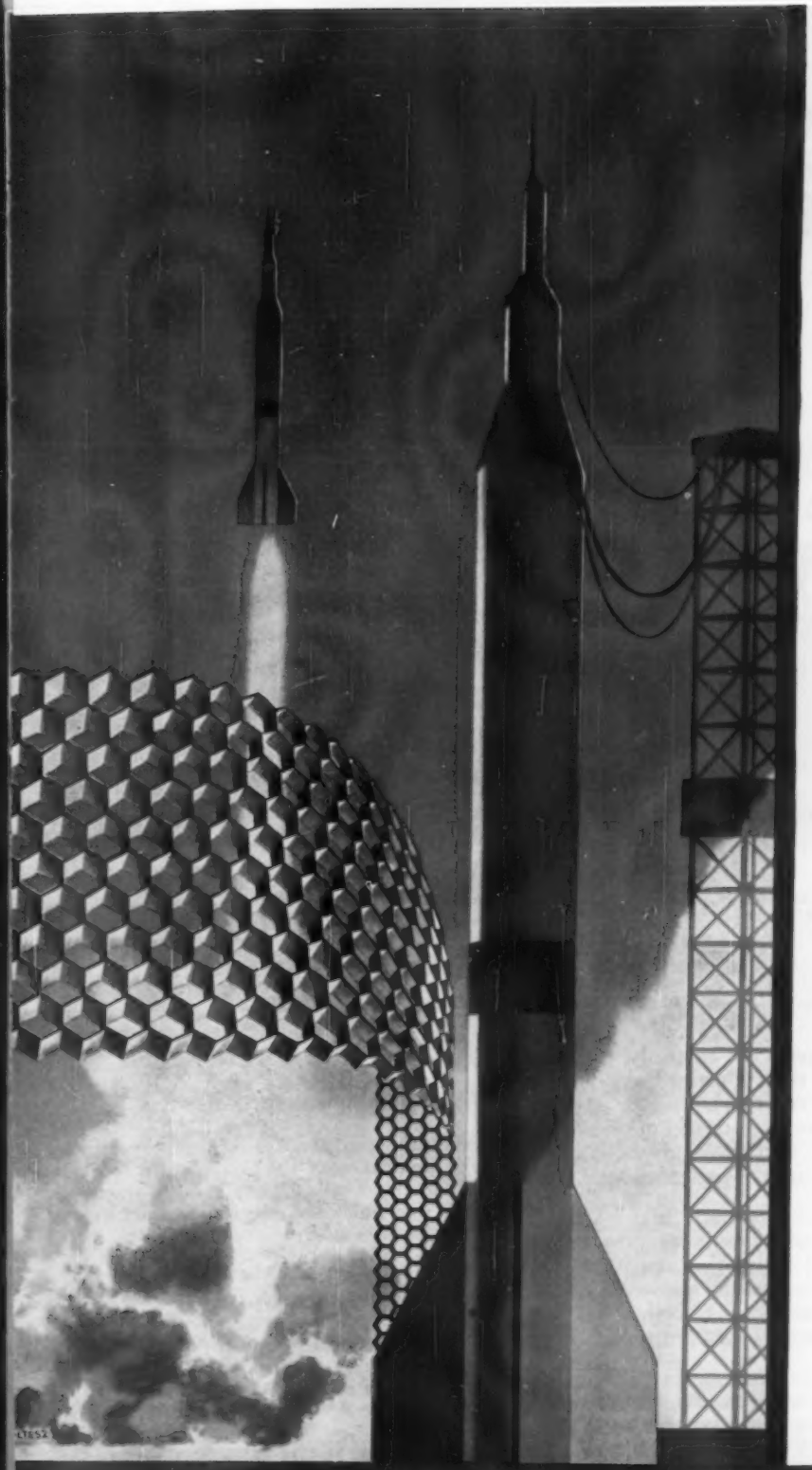
ACTIVITIES VITAL TO NATIONAL DEFENSE: Missiles—Navy Sparrow III and Army Hawk; bombing radar for the B-52; DEW line radar; tubes, transistors; magnetrons, amplitrons, klystrons and backward wave oscillators.

REPUTATION: World-wide.

RAYTHEON

Excellence in Electronics

RAYTHEON MANUFACTURING COMPANY
Waltham, Massachusetts



Steel structures for space... from Crosley

Today's missiles require materials that are lighter, stronger and more heat resistant. Such requirements make Avco-Crosley a leading contender for building missile frames and structures.

Avco-Crosley is a pioneer in the development of stainless-steel honeycomb, a structural material that is cutting deep into the "thermal barrier" that so long has limited the speed at which planes and missiles travel through the air.

Using stainless-steel honeycomb, it is now possible to build structures with great heat tolerance and high strength/weight ratio: with the strength of solid steel, yet weighing only one-tenth as much.

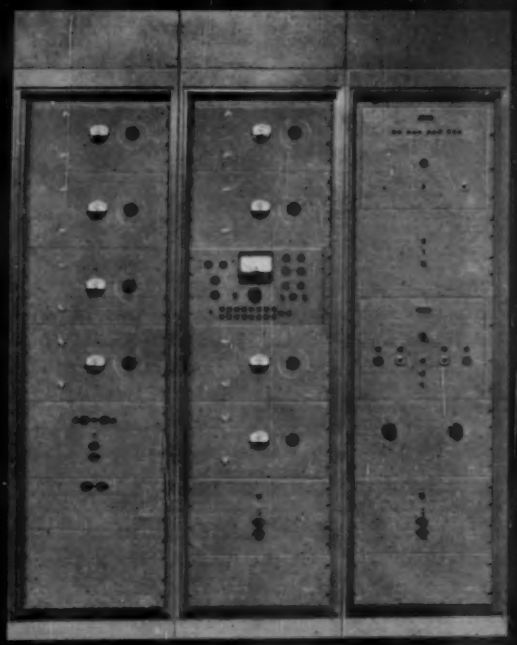
Together with its associated Avco divisions, the Crosley Division now provides facilities and personnel for:

- *Weapon systems management, from initial concept to production.*
- *Research, development and engineering design of: missile nose cones, air frames, electronics, control systems, telemetering, automatic test and support equipment, ground handling equipment and logistics.*
- *Production and manufacturing for missile and aircraft systems.*

For more information, write to: Vice President, Defense Products Marketing, Crosley Division, Avco Manufacturing Corporation, Cincinnati 25, Ohio.

Avco // Crosley

NEW SIMPLICITY OF OPERATION



with Bendix-Pacific

TELEMETERING GROUND STATIONS

Bendix-Pacific FM/FM Receiving Stations have achieved a new high in operational simplicity. Comparator type circuitry, highly stable components and automatic calibration techniques eliminate all controls except channel selection and calibration switches. With Bendix-Pacific stations, high accuracy data can be obtained in a shorter time than ever before.

Bendix-Pacific Receiving Station Systems represent the most advanced state of the art. Two types are available: The **TGRS-100 Receiving Station** is designed for either real time reception and demodulation of signals from FM/FM Telemetry Transmitting Systems or demodulation of tape recorded data. The **TGRS-600 Receiving Station** is designed primarily for precision conversion of tape recorded information from FM to analog.

Bendix-Pacific maintains a complete staff of instrumentation personnel to assist you in the solution of your data problems. Contact —

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Canadian Distributors: Computing Devices of Canada, Ottawa 4, Ontario
Export Division: Bendix International, 205 E. 42nd Street, New York 17, New York

AVIATION CALENDAR

(*Continued from page 5*)

strument Society of America, Philadelphia Convention Hall, Philadelphia, Pa.

Sept. 22-24—1958 Meeting, Professional Group on Telemetry and Remote Control, Americana Hotel, Bal Harbor, Miami Beach, Fla.

Sept. 22-24—Seventh Annual Meeting, Standards Engineers Society, Benjamin Franklin Hotel, Philadelphia, Pa.

Sept. 25-27—Fifth Annual National Western Forum, American Helicopter Society, Ambassador Hotel, Los Angeles, Calif.

Sept. 25-28—Air Force Assn. Annual Convention and Airpower Panorama, Dallas.

Sept. 28-Oct. 2—114th Meeting, Electrochemical Society, Chateau Laurier, Ottawa, Canada.

Sept. 29-Oct. 3—National Aeronautical Meeting, Society of Automotive Engineers, Inc., the Ambassador, Los Angeles.

Sept. 29-Oct. 3—Semi-Annual Meeting and Western Tool Show, American Society of Tool Engineers, Shrine Exposition Hall, Los Angeles, Calif.

Oct. 1-2—Conference on Radio Interference Reduction, sponsored by Armour Research Foundation and U. S. Army Signal Engineering Laboratories, Museum of Science and Industry, Chicago, Ill.

Oct. 1-3—National Airports Conference, University of Oklahoma, Norman, Okla. Co-sponsored by American Assn. of Airport Executives and the CAA.

Oct. 4—Second Annual Awards Banquet, Society of Experimental Test Pilots, Beverly Hilton Hotel, Beverly Hills, Calif.

Oct. 6-7—National Symposium on Extended Range and Space Transmission, sponsored by Institute of Radio Engineers and George Washington University, Lisner Auditorium, Washington, D. C.

Oct. 6-7—Champion Spark Plug Co.'s Distributor and Business Aircraft Operators Clinic, Secor Hotel, Toledo, Ohio.

Oct. 7-8—1958 Joint Meeting, Institute of the Aeronautical Sciences and Canadian Aeronautical Institute, Chateau Laurier, Ottawa, Canada.

Oct. 7-12—Sixth International Communications Convention, Genoa, Italy.

Oct. 8-10—14th Annual Aviation Spark Plug and Ignition Conference, Champion Spark Plug Co., Secor Hotel, Toledo.

Oct. 9-10—Ninth Annual National Noise Abatement Symposium, sponsored by Armour Research Foundation, Hotel Sherman, Chicago, Ill.

Oct. 13-15—14th Annual National Electronics Conference, Hotel Sherman, Chicago, Ill.

Oct. 15-17—Twelfth Annual Meeting, Southeastern Airport Managers' Assn., The Palm Beach Terrace, Palm Beach.

Oct. 22-24—Fifth National Vacuum Symposium, Sir Francis Drake Hotel, San Francisco, Calif.

Oct. 23-25—1958 National Simulation Conference, sponsored by Institute of Radio Engineers Professional Group on Electronic Computers, Statler-Hilton Hotel, Dallas, Tex.

Oct. 27-28—East Coast Conference on Aeronautical & Navigational Electronics, Institute of Radio Engineers, Lord Baltimore Hotel, Baltimore, Md.

in depth!

VARIABLE DISPLACEMENT PUMPS

Model Series.....PV062
Theoretical Dspl. .950 cu in./rev

Model Series.....PV104
Theoretical Dspl. 1.600 cu in./rev

Model Series.....PV153
Theoretical Dspl. 2.350 cu in./rev

**Similar inherent performance advancements shown for the smaller pump sizes be carried over to these models.*

IMPROVED RESPONSE

The PV006 series is capable of full flow to zero flow response in 0.02 sec and zero flow to full flow response in 0.04 sec without pressure oscillation.

MINIMUM PACKAGE

These PV series variable displacement pumps have practically the same envelope as constant displacement units of equal output. In comparison with standard variable pumps, the reduction in envelope varies from 70% to 15% as size increases.

IMPROVED CONTAMINATION RESISTANCE

Performance of these new pumps is greatly improved even when operating with contaminated oil. This improved contamination tolerance results from changes in both design and materials.

IMPORTANT WEIGHT SAVING

The new advanced design pumps represent a 100% increase in power-to-weight ratio over any other variable displacement pumps now available. The magnitude of this improvement is evident from the fact that every added pound of component increases a missile's gross weight from 30 to 75 pounds.

IMPROVED RELIABILITY

Exceptional capabilities (high speed, long life and contamination tolerance) under extreme conditions . . . even greater under normal application.

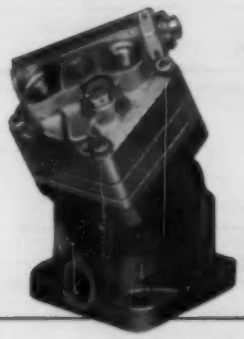
PARTS STANDARDIZATION

Major parts are interchangeable for fixed and variable displacement pumps and for fixed and variable motors in each series. This standardization results in customer savings.

Design breakthrough now

VICKERS. ADVANCED DESIGN

(PV SERIES)



Model Series	PV006
Theoretical Dspl.	.095 cu in./rev
Rated Speed	12,500 rpm
Weight	2.4 lb
Hp/lb @ Rated Speed	3.8
Bolt Spacing	1.875"
Overall Length	4⅛"

Model Series	PV012
Theoretical Dspl.	.188 cu in./rev
Rated Speed	10,000 rpm
Weight	4.2 lb
Hp/lb @ Rated Speed	3.4
Bolt Spacing	3.536"
Overall Length	5 7/32"

Model Series	PV024
Theoretical Dspl.	.367 cu in./rev
Rated Speed	8,000 rpm
Weight	5.9 lb
Hp/lb @ Rated Speed	3.8
Bolt Spacing	3.536"
Overall Length	5⅞"

Model Series	PV039
Theoretical Dspl.	.600 cu in./rev
Rated Speed	8,000 rpm
Weight	9.5 lb
Hp/lb @ Rated Speed	3.8
Bolt Spacing	3.536"
Overall Length	6 13/32"

• "Design breakthrough" as used on this page is a carefully considered statement. Here is the lineup of the PV series fixed angle variable displacement hydraulic pumps for aircraft and missiles systems optimization. The numerous important improvements briefly discussed at the right indicate that these advanced design pumps are destined to set new standards of performance.

All series have integral automatic pressure compensator and a broad range of control methods. This advanced design requires substantially fewer parts than conventional design . . . and it has reduced to a minimum the number of external sealing elements. Now, for the first time, the power saving (and heat rejection) advantages of variable displacement are available in pumps of fixed displacement envelope and weight.

When first announced last March, only the smallest unit (Series PV006) had completed exhaustive endurance tests and was available. Now three more series (PV012, PV024 and PV039) are ready for system application. Three larger sizes are in the development stage. *For further information write for Bulletin A-5233.*

VICKERS INCORPORATED

DIVISION OF SPERRY RAND CORPORATION

Aero Hydraulics Division • Engineering, Sales and Service Offices:

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Aero Hydraulics Division District Sales and Service Offices

Albertson, Long Island, N.Y. • Arlington, Texas

Seattle 4, Washington • Washington 5, D.C.

Additional Service Facilities at: Miami Springs, Fla.

IMPROVED LIFE

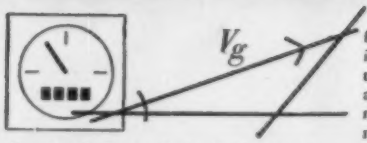
Exhaustive endurance tests have proved these new pumps meet the requirement of new MIL-P-19692 specification (i.e., 750 hours at rated rpm which is a very substantial increase over the 560 hours previously required).

INCREASED SPEED CAPABILITIES

The maximum recommended speeds (both continuous and intermittent) have been greatly increased for all sizes without exception . . . more than doubled for some models.

SAME HIGH EFFICIENCY

Volumetric efficiency is from 96% to 98% over a pressure range of 500 to 3000 psi. All the improvements enumerated here have been made without any sacrifice of the exceptionally high efficiency inherent in Vickers axial piston type pumps . . . under partial as well as full flow conditions.

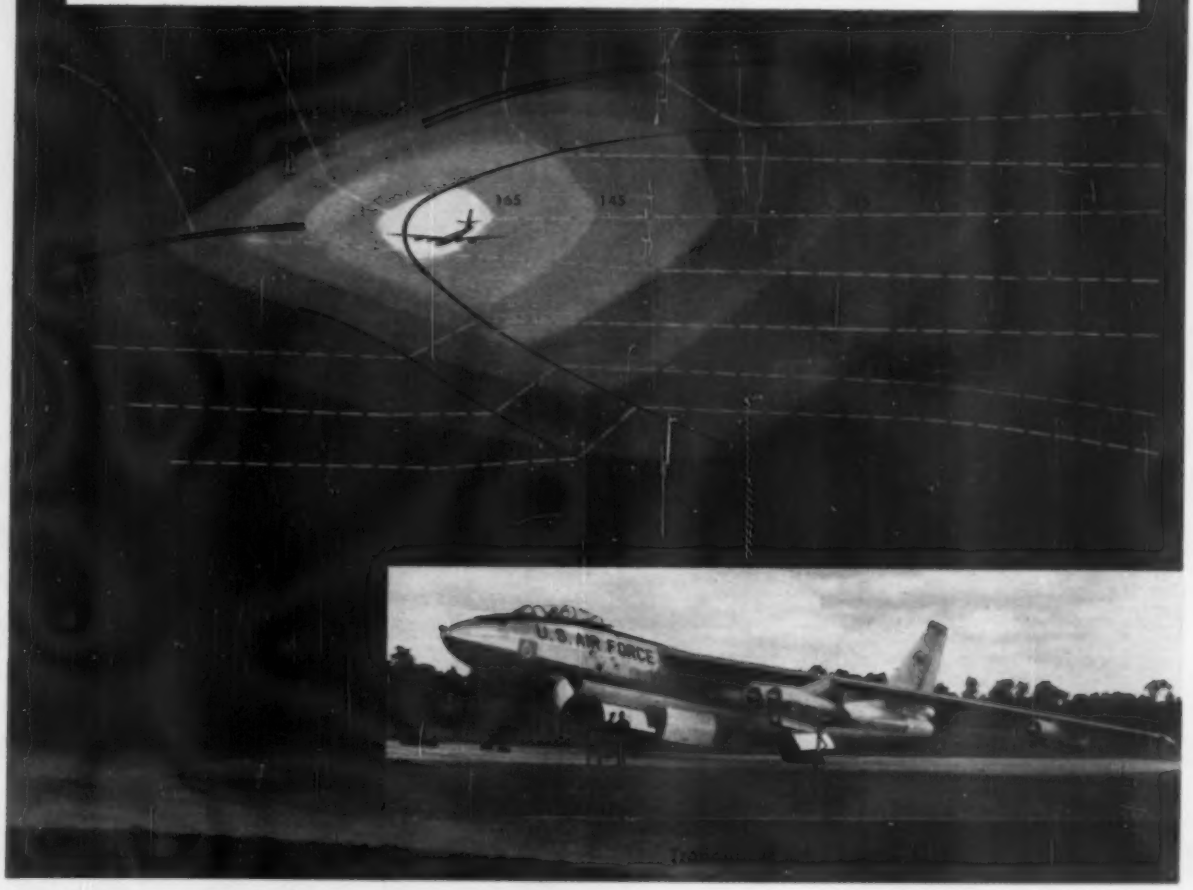


Ground Speed & Drift Angle
Any Time, Anywhere, Any Weather

Jet streams were cross-sectioned for the first time using the capabilities of GPL auto-navigators. Now these same ground speed and drift angle measuring equipments make riding aerial "express-ways" easy for military and civilian fliers.

A leading news magazine's story on the record-setting B-47 flight defined jet stream flying this way:

"To find the jet stream the pilot flies in its general direction . . . When the '66' tells him that his drift angle is increasing, he knows that he is getting into the jet stream . . . When the drift angle reaches a maximum, he turns downstream until the drift angle falls to zero... When the '66' is hooked to the autopilot, the airplane will follow the stream automatically, getting maximum benefit."



Cross-section of a headline

Headlines were made the day a GPL auto-navigator guided a USAF B-47 into the jet stream over California, set her down only 3 hours and 47 minutes later in sight of the Atlantic!

This dramatic use of GPL Doppler Navigation Systems is just one application of their basic function – precise point-to-point navigation – any time, anywhere, any weather. The systems work without ground aid or celestial fixes, have proved themselves over many millions of operational miles. They offer military and civilian pilots continuous, accurate navigation information, including velocity.

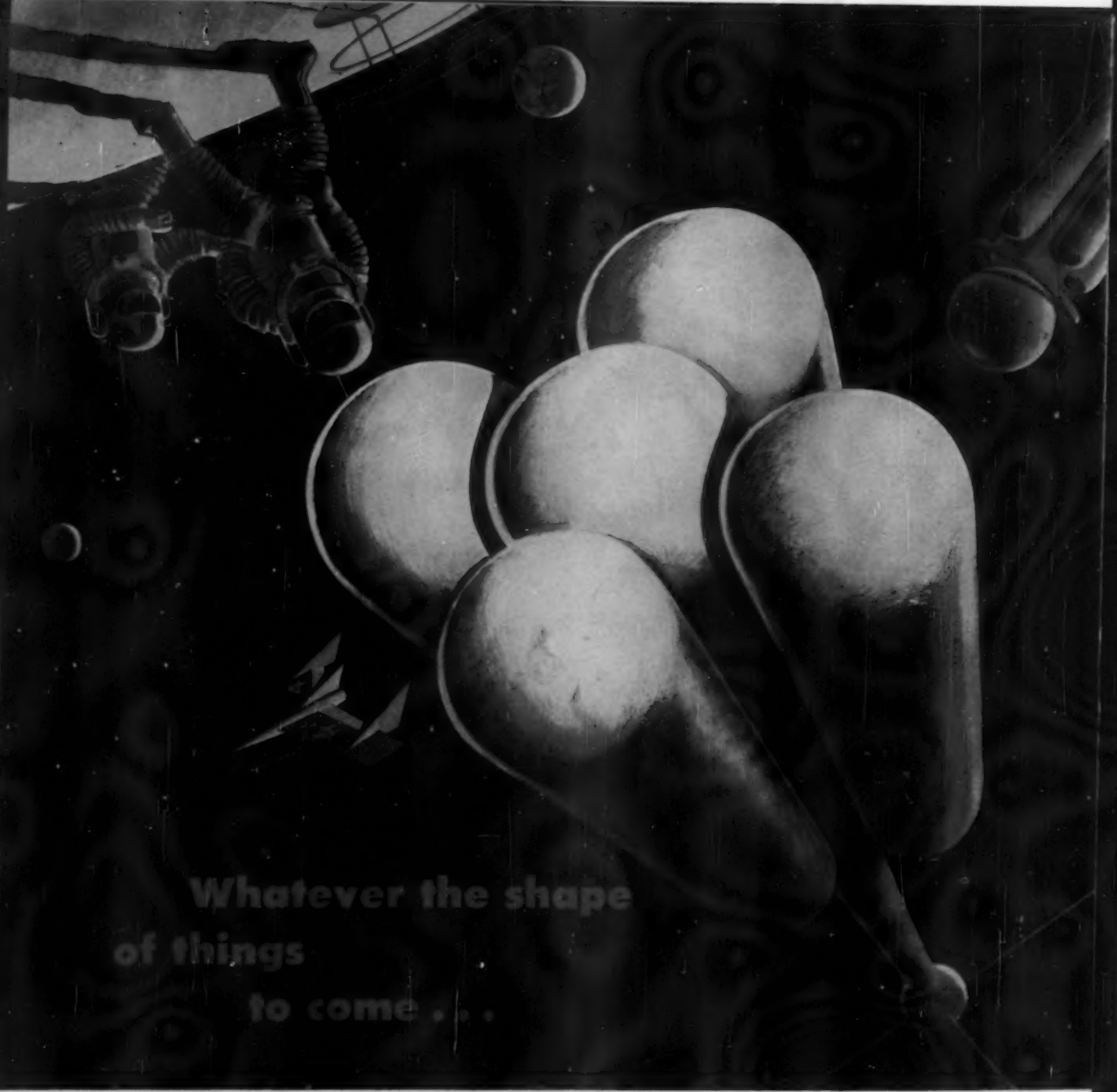
RADAN* Navigation Systems, recently released for civilian use, are now available to everyone. They save precious time and fuel for the air lines, provide a priceless margin of safety for all.

GPL | GPE

GENERAL PRECISION LABORATORY INCORPORATED, Pleasantville, N. Y.

*Trademark

ENGINEERS – GPL achievements have opened up some unusual research and development opportunities. Send resumé to Personnel Manager.



58-16

Fantastic shapes for the space vehicles of the future already are on the boards. Even more radical designs are taking form in the minds of engineers. And their parts and components will just as radically differ from those produced today. New standards of precision and new methods of working new materials will be required.

One thing at least is certain: the same design, development and manufacturing experience which made the transition from aircraft piston engines to jets will be needed to produce these shapes of the future. Since the early 1920's, Ex-Cell-O has been among the major suppliers of machines, parts and assemblies to the aircraft industry. In that time it has built a reputation for extending the frontiers of precision.

Today, Ex-Cell-O manufactures such components as: rotors, blades, fuel nozzles, actuators, valves and fuel controls. Tomorrow? Well, perhaps you yourself have a problem which Ex-Cell-O's long experience in the production of precision controls and assemblies might help you solve. If so, why not contact Ex-Cell-O today?

EX-CELL-O FOR PRECISION XLO

EX-CELL-O CORPORATION
DETROIT 32, MICHIGAN
Aircraft Division

MAN AND MISSILES FLY HIGHER, FASTER AND SAFER WITH PARTS AND ASSEMBLIES BY EX-CELL-O

beneficial occupancy of test sites ....is the crux of efficient missile development

...AND ON-TIME ACTIVATION OF TEST SITES IS THE PRINCIPAL PRODUCT OF PAP'S SYSTEMS ENGINEERING.

The enormous benefits in terms of economy and adherence to schedule that result from on-time availability of test and launch sites are well understood by all missile developers. Almost as well known is the fact that every site for the Atlas missile program has been completed on or ahead of schedule.

PAP's vital tasks in this accomplishment have included design, manufacture, and installation of all electronic cable; installation of instrumentation, controls, consoles, and accessories; and checkout and validation of the complete electronic complex.

PAP has **demonstrated** its ability to modify test stands in support of missile design changes in less time, at lower cost — therefore PAP can best support your firing schedule.

For a complete report on PAP's performance on the Atlas program, or for a prompt proposal on the services that can be supplied on other missile programs, address Arthur P. Jacob, Executive Vice-President.

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PACIFIC AUTOMATION PRODUCTS, INC.

1000 AIR WAY, GLENDALE 1, CALIFORNIA *Phone: CHapman 5-8067 or Citrus 6-2411*

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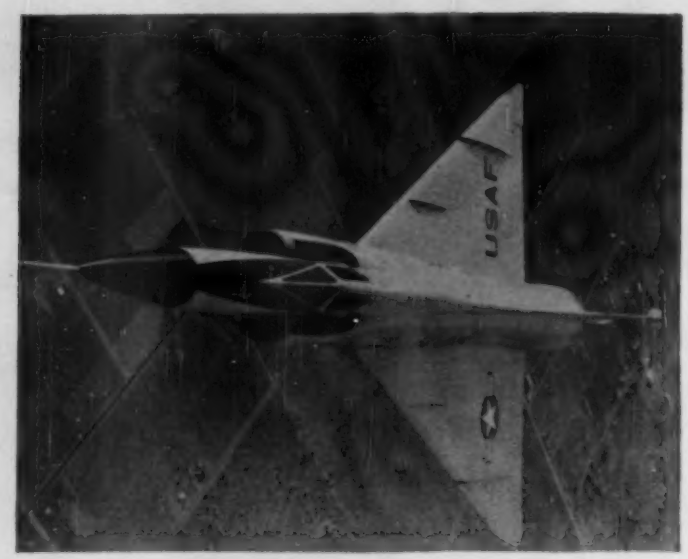
the exciting services which PAP provides can make an exciting career for you.
Send your resume today.

Announcing the formation of **SPACE ELECTRONICS CORPORATION**, an affiliate of Pacific Automation Products, Inc. to engage in development of Space and Base Electronic equipment - **Dr. J. C. Fletcher**, President - **F. W. Lehan**, Vice-President - 1200 Air Way, Glendale 1, Calif.

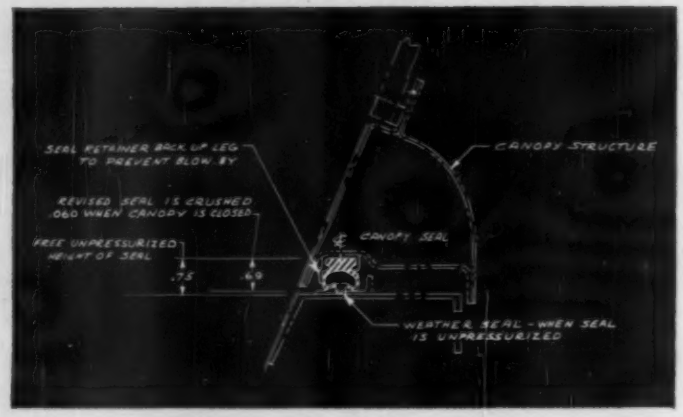
The PLANE

Convair's F-102A, USAF single-seat, supersonic, all-weather, delta-wing fighter. The F-102A was the first of Convair's supersonic delta wings to become operational. It is powered by one Pratt & Whitney J-57-P-35 turbojet, with afterburner.



The PROBLEM

Canopy seal. A positive seal must be maintained between canopy and fuselage to hold cockpit pressure. The seal must stay resilient when exposed to extreme temperatures at flight altitudes; must also resist a relatively high concentration of ozone.


SEAL RETAINER BACK UP LEG TO PREVENT BLOW BY
REVISED SEAL IS CRUSHED .060 WHEN CANOPY IS CLOSED
FREE UNPRESSURIZED HEIGHT OF SEAL
.75
.69
CANOPY STRUCTURE
CANOPY SEAL
WEATHER SEAL - WHEN SEAL IS UNPRESSURIZED

The PART

SILASTIC

SILICONE RUBBER

Silastic*, the Dow Corning silicone rubber, was specified for this seal because of its elasticity at —130 F; its resistance to ozone, moisture, and extreme temperature cycling; and its low compression set. Silastic will meet your seal requirements, too: ask your rubber supplier for further information, or write Dept. 098.

*T.M. REG. U.S. PAT. OFF.

first in silicones

Dow Corning
CORPORATION
MIDLAND, MICHIGAN

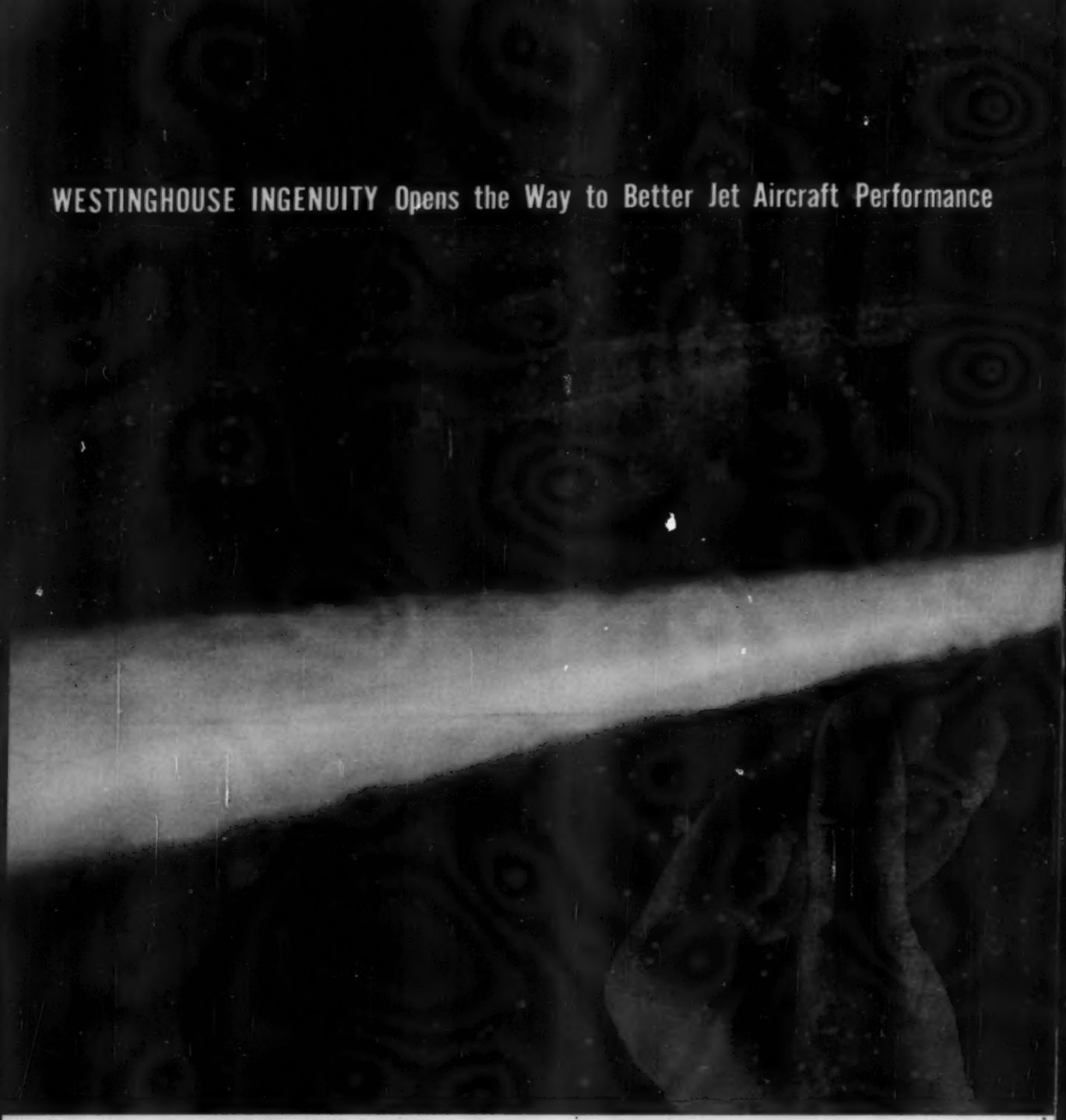
engine. A few of the Westinghouse "firsts" in the field include the axial flow compressor, iris exhaust nozzle, annular combustion chamber and step wall combustion liner.

The Aviation Gas Turbine Division is a completely integrated facility for design, development, testing and production of propulsion systems. For further information, write: Westinghouse Electric Corporation, Aviation Gas Turbine Division, P.O. Box 288, Kansas City, Missouri. J-54047

YOU CAN BE SURE... IF IT'S

Westinghouse

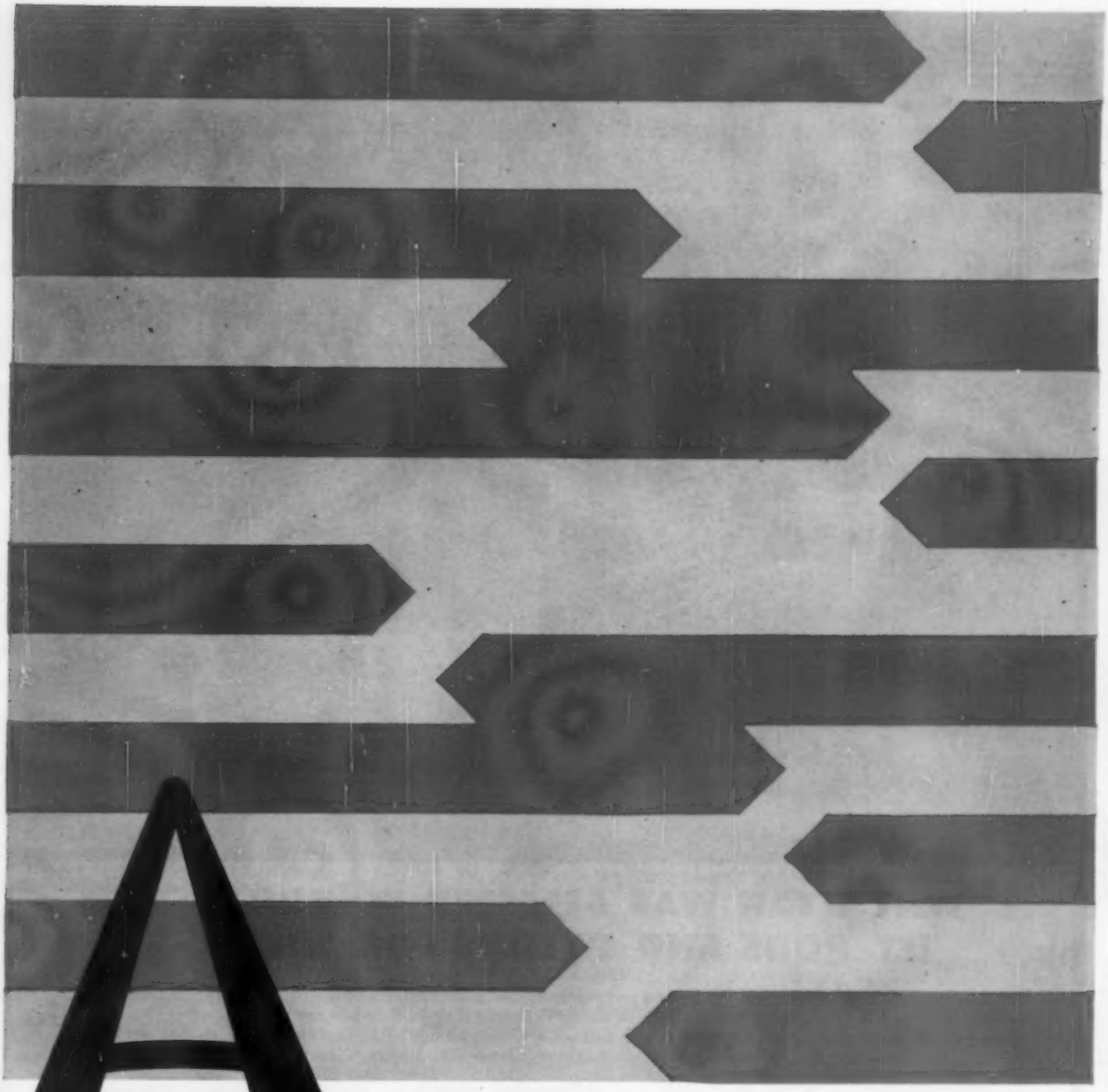
WESTINGHOUSE INGENUITY Opens the Way to Better Jet Aircraft Performance



1004 Jet Inventions in the Last Two Years

Engineering and research scientists at Westinghouse made 1004 invention disclosures—each representing an improvement in jet engine design—during 1956 and 1957. The number of inventions this year is keeping pace with previous years, proving that creative engineering at Westinghouse is striving constantly toward better, more efficient jet propulsion.

Westinghouse, designer and builder of the first American turbojet, now holds more than 175 U. S. patents—many of them basic patents—on the jet



ASTRODYNE —aimed for the future in solid rocketry

Astrodyne was founded early this year to bring together in one productive group all the skills, experience, and facilities it takes to design and manufacture America's major solid propellant missile systems.

From Phillips Petroleum Company came men with impressive backgrounds in research, design, and manufacture of superior solid propellants. From North American Aviation came men who know missile systems management, and who have designed and built the largest rocket engines in use today.

Today Astrodyne has the experience to design, develop, and manufacture complete propulsion systems, extruded and cast propellants, solid propellant rocket motors, and boosters, and gas generator charges for auxiliary power units.

Inquiries are welcomed on any phase of the solid propellant field—from preliminary design to quantity production.

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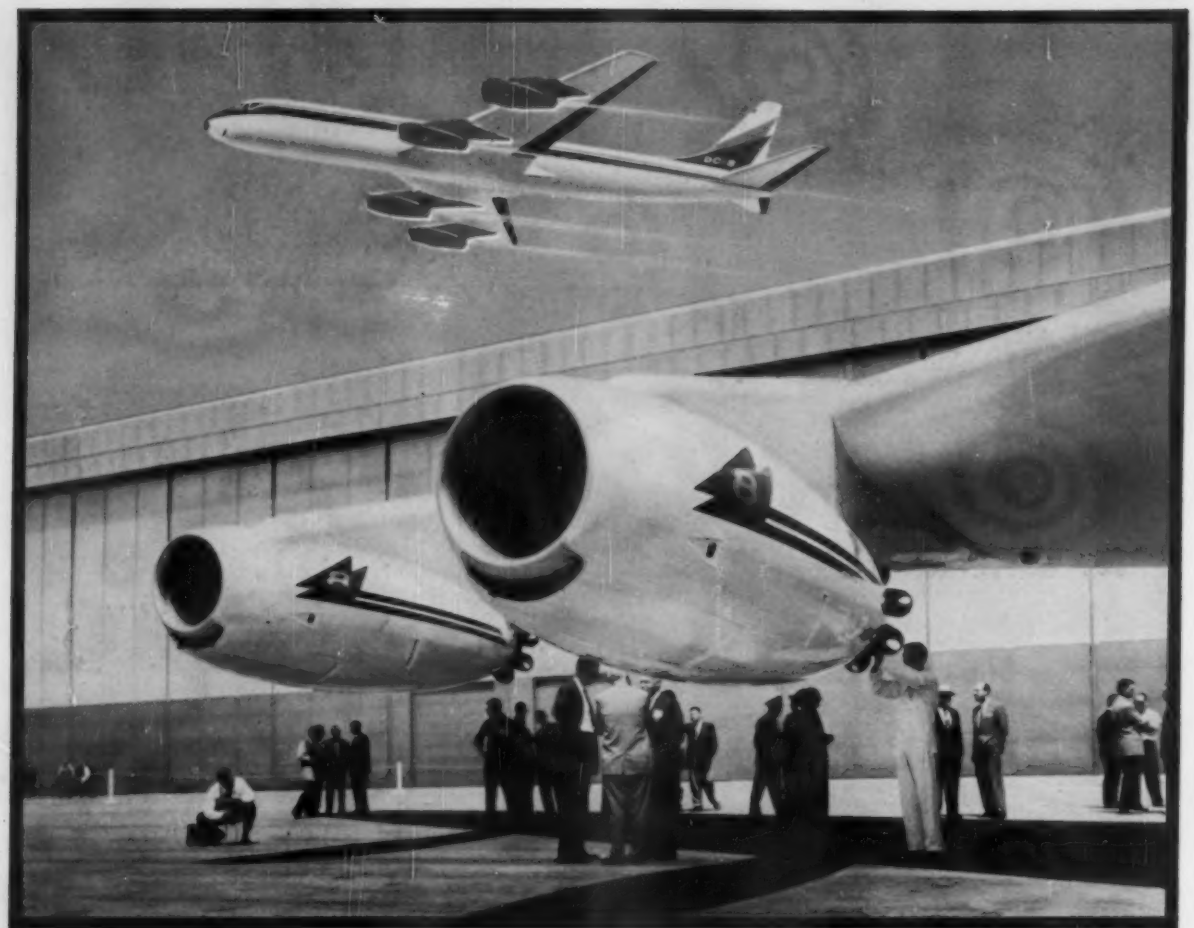

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August 18, 1958

Aviation Week

Including Space Technology

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PICTURE CREDITS

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EDITORIAL

Space Team Leaders

President Eisenhower's nomination of T. Keith Glennan, president of the Case Institute of Technology in Cleveland, as administrator and Hugh L. Dryden, director of the National Advisory Committee for Aeronautics, as deputy administrator of the new National Aeronautics and Space Administration is the latest in a series of moves designed to get this vital agency into dynamic action as quickly as possible.

Mr. Glennan's nomination to the NASA top post should be viewed from the perspective of the administration's temptation to pass this juicy $22,500 a year plum to a purely political henchman as a patronage gesture.

In comparison with some of these types who were under active consideration, Mr. Glennan's appointment is a step in the right direction. He has some technical background in electronics, a field in which the old NACA never needed much capability but which is vital for the new space agency. He also has experience in the Washington political mill as a former member of the Atomic Energy Commission. Mr. Glennan is no stranger either to the personnel, operating methods or achievements of the National Advisory Committee for Aeronautics which will be the nucleus of his new agency.

In Cleveland, he had an opportunity to watch the workings of the NACA's Lewis Propulsion Laboratory and knows well its able director, Edward R. Sharp, and his principal technical aide, Abe Silverstein, who is destined to play an increasingly important role in the space area of NASA. It is the Lewis Laboratory that has already explored new methods of propulsion required for space exploration such as high energy rocket fuels, ion propulsion and nuclear powerplants. Mr. Glennan has a demanding and difficult task ahead of him. He will need all of the support that he can get from industry, science, government agencies and the American public.

Mr. Glennan is particularly fortunate in having the personnel, laboratories and reputation of the NACA as the nucleus for the new agency. It would be impossible to find a more solid, ready-made foundation on which to build the new venture. However, we must confess that we share the general disappointment over the failure of the President to nominate Dr. Hugh L. Dryden to the top NASA post which he richly deserved, both for the outstanding technical record of NACA under his leadership during the past decade and for his selfless devotion to the service of his country in the face of the persistent prospect of much higher financial reward from private industry.

There is no glossing over the fact that Congress and the President have given Dr. Dryden shabby treatment. Coming at the same time as the pointed omission of Adm. Hyman Rickover, the pioneer in nuclear powered submarines, from White House ceremonies honoring the transpolar underseas cruise of the Nautilus, it spotlights one of the symptoms of basic friction between scientists and military and political brass that has done so much to retard our weapons development potential.

We are appalled and deeply disappointed by the performance of certain members of the House Select Committee on Astronautics and Space Exploration who marred an otherwise sound record with a bitter and thoroughly unwarranted attack on Dr. Dryden while the nominations were under final consideration. There is nobody in the House or Senate who can surpass Dr. Dryden's record for selfless service to his country during the past two decades and particularly during his brillant tenure as director of NACA since 1947.

We suspect there were three main sources of congressional dissatisfaction with Dr. Dryden. All are equally invalid.

First, he was in the position, shared by so many military and federal agency leaders, of having to present a budget to Congress which everybody agrees was grossly inadequate. NASA was permitted by the Budget Bureau, which still regards the whole exercise as a costly sop to public opinion and of little real value, about half the amount Dr. Dryden and his cohorts proposed to support the initial space exploration program.

Second, some committee members, who were impatient to have photon propulsion perfected tomorrow and who demonstrate their erudition to scientist witnesses by "proving" how it is possible to go 20 mph. faster than infinity, resented the rock-ribbed scientific integrity displayed by Dr. Dryden when he refused to indorse proposals expounded by the "snake oil" salesmen of space and stubbornly insisted on a scientifically sound and valuable program. It is this very fact that Dr. Dryden has in the past had the moral courage and scientific soundness to resist firmly the pressures generated by technical "snake oil" salesmen that has made his administration of NACA so successful and universally respected in international technical circles.

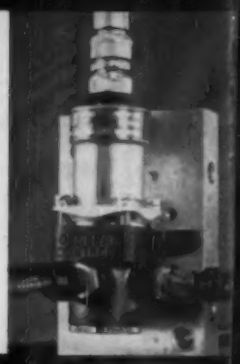
Third, some committee members seemed to think that wild promises of "outrunning the Russians" would accomplish more than a scientifically sound program vigorously executed. They completely ignored the fact that, during the 10 years of Dr. Dryden's regime at NACA, this country remained significantly and consistently ahead of the Soviets in what was then NACA's main area—supersonic combat aircraft. Here is the sad spectacle of a man who kept his agency well ahead of the Soviets in technical development for 10 years being pilloried by some congressmen because he prefers to back his position with a record of solid performance instead of "pie in the sky" claims which nobody could really substantiate today.

It is no secret that Dr. Dryden has been bombarded with offers from private industry ranging up to six figures during the period when he has toiled earnestly and uncomplainingly on a government salary of $20,000. It is this example, plus the technical freedom and soundness of the NACA research and development program, that has kept dozens of its key technical people from drifting off to bigger financial rewards from private industry.

It is a true measure of the man that Dr. Dryden was willing to accept the post of second in command of NASA where he will continue to work wholeheartedly for the success of the agency's mission rather than chuck the whole situation with justified disgust, pluck an industrial plum and leave his congressional critics to be wrung out by the "snake oil" salesmen of space.

Our hat goes off to Dr. Dryden!! —**Robert Hotz**

VIBRATION



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WHO'S WHERE

In the Front Office

Brig. Gen. Bernard S. Barron (USMCR) and **Lt. Col. I. Robert Kriendler** (USMCR), directors, Mycalex Corporation of America, Clifton, N. J.

John Spaulding, president, Skil Corp., Chicago, Ill., succeeding Bolton Sullivan, now board chairman.

George F. Metcalf, regional vice president-Washington Defense Activities, General Electric Co., Washington, D. C.

Derek Richardson, vice president-aluminum sales, Metals Division, Olin Mathieson Chemical Corp., New York, N. Y.

J. T. Cataldo, vice president-sales, International Rectifier Corp., El Segundo, Calif.

Donald R. Spotz, vice president-sales, Pesco Products and Wooster Divisions, Borg-Warner Corp., Bedford, Ohio.

William Jaroscak, assistant to the president, Midland Aircraft Corp., Los Angeles, Calif.

Robert C. Downie, assistant to the president, National Electric Products Corp., Pittsburgh, Pa.

Convair Division of General Dynamics Corp., has announced the following appointments: **R. B. Swanson**, general manager-Washington, D. C., office and assistant to T. G. Lanphier, Jr., vice president and assistant to the president. Other Washington office appointments: **E. J. LeFevre**, manager-Air Force, and **David Rowland**, manager-Army. **J. P. Shaw** will continue as manager-Navy and assume the post of assistant general manager. **E. F. Jones**, assistant to the vice president, Washington's eastern public relations director.

Honors and Elections

William Littlewood, American Airlines vice president-equipment research, Washington, D. C., has been named the 1958 recipient of the Daniel Guggenheim Medal for "leadership and continuous personal participation . . . in developing the equipment and operating techniques of air transport."

J. L. Singleton, vice president of Allis-Chalmers' Industries Group, has been elected president of the National Electrical Manufacturers Assn., New York, N. Y., to fill the term of the late W. V. O'Brien of the General Electric Co.

W. W. Wilson, Qantas navigator, has been elected chairman of the International Airline Navigators Council.

Changes

Arthur R. Christie, a consultant to United Aircraft Corp., East Hartford, Conn.

Capt. F. D. Hall, system general manager-flight operations, Trans World Airlines, Inc.

Kenneth P. Bowen, assistant to the general manager, Sierracin Corp., Burbank, Calif. Also: **Charles C. Austin**, Wright Field representative, and **James M. Tompkins**, Washington, D. C., representative.

William L. Vaughan, manager-purchasing, Solar Aircraft Co., San Diego, Calif.

(Continued on p. 111)

INDUSTRY OBSERVER

► Scientists associated with Army's satellite program believe manned space flight may be delayed by several decades if the ultra high intensity radiation discovered by Explorers III and IV (p. 32 and AW Aug. 11, p. 20) extends indefinitely into the solar system, doubling in intensity every 60 mi. as early data indicates it does at altitudes up to at least 1,200 mi. One of Army's lunar probe shots will be instrumented to seek data as to how far in space the radiation extends. Army also has received permission from Advanced Research Projects Agency to work on an additional three satellite projects, including a radiation test, an inflatable sphere and a cosmic ray experiment similar to that conducted by Explorer I.

► **Kaman Aircraft Corp., Bloomfield, Conn., is negotiating with Britain's Fairey Aviation Co. Ltd. to produce Fairey Rotodyne VTOL aircraft in the U. S. under license. Working arrangements for Kaman military and commercial rights in the U. S. and its territories have been completed but formal license agreement has not been signed.**

► Most Soviet jet fighter aircraft now in operation have a thrust equal to or greater than their weight, according to Russian designer A. M. Mikoyan. Western aircraft with similar characteristics include the Lockheed F-104 and Canada's Avro CF-105.

► **Sikorsky Division of United Aircraft Corp. expects to have the "B" version of its turbine-powered amphibious S-62 helicopter flying early in 1959. New model will incorporate S-58 rotor system and new gear box. Upgrading of General Electric T58 engine is expected to produce up to 1,250 hp. Normal cruise speed is estimated at 125 kt., as compared to 90 kt. for the S-62A.**

► One Soviet design proposal for solving the structural heating problem on high supersonic speed aircraft calls for a layer of Fiberglas about one inch thick between the outer skin and the inner structure that bears the primary loads. Russians indicate that at one altitude and speed this insulation layer would increase the time from three minutes to one hour that the inner structure requires to heat from minus 60C to plus 80C.

► **Curtiss-Wright Corp., General Electric Co. and Nuclear Development Corp. of America are making preliminary studies for Atomic Energy Commission related to selection of reactor concepts most promising for mobile use. Defense Department would like systems of moderate power rating, extreme compactness, low weight.**

► Convair Division of General Dynamics Corp. has an Atomic Energy Commission contract to survey all available information on lightweight shielding development, and to arrive at detailed requirements for an experimental program necessary for development of shielding for compact reactors.

► **Bell Aircraft Corp. is developing a high-performance inertial navigator designated the Hipernas II under Army contract for use in connection with Army's surveillance drone programs and Air Force satellite and space vehicles.**

► Observatory of Bonn University has been chosen by the Army as the first official Explorer control station in Europe. U. S. measuring and recording equipment arrived just in time to facilitate reduction of data received from Explorer IV. Second European station will be at Heidelberg University.

► **Further studies of results of an underground explosion of a 1.7 kiloton nuclear device in Nevada last September have led Atomic Energy Commission to conclude that devices 100 times that yield could be fired safely underground, both for weapons tests and peaceful uses. Explosion fused at least 700 tons of material and crushed about 500,000 tons of tuff to sand. Temperatures up to 194F still existed in the central region three months after the shot.**

► Ralph M. Parsons Co., of Los Angeles, will make a survey of possible sites for missile test ranges in several NATO countries under a contract from NATO's Advisory Group for Aeronautical Research and Development.

Washington Roundup

Air Defense Decision

Problem of what mixture of defense weapons will be chosen for use in the near future (AW Aug. 11, p. 21) now is in the hands of the Joint Chiefs of Staff. They will make recommendations to Defense Secretary Neil McElroy, who was briefed last week on the entire continental defense picture by Director of Guided Missiles William Holaday's office. Congress had pushed the whole question of defensive weapons toward a showdown by reducing defense requests for USAF Bomarc and Army Nike Hercules bases, and warning that the country cannot support warning and control networks, interceptors and a variety of missiles all at once. McElroy has been directed to determine what missile or combination of missiles he wants to defend specific areas. Pentagon observers believe the decisions may involve killing either the Bomarc or Nike Hercules systems.

R & D Funds

Air Force channels 49% of its research and development funds into private industry, Navy 47.8% and Army only 41%, according to data submitted by Defense Department to the House Government Operations Committee. Other funds go to:

- **Universities or other non-profit institutions:** Army, 11%; USAF, 10%; Navy, 6.1%.
- **Within government:** Army, 48%; Navy, 46.1%; and USAF, 41%.

Pyle Objection

Civil Aeronautics Administrator James Pyle has taken issue with the airlines over what he terms "distorted" use of the phrase "air traffic control delay" by airline station managers explaining late arrivals and departures to passengers. In a letter to 33 airline presidents, Pyle complained that this explanation by public address system and counter signs was "all too often used automatically" and called for a factual announcement of each individual delay when necessary as a means of building public confidence in airline operations and the air traffic control system.

National Air Museum

Hopes for approval of plans and appropriation requests for a National Air Museum in Washington by the present session of Congress were revived last week when the House Public Works Committee reported out the Senate bill favorably. Exact location of the museum must be approved by the National Capital Planning Commission. The design must be approved by the Commission of Fine Arts.

Runway Debate

Air Line Pilots Assn. says runway configurations for the proposed Washington International Airport at Chantilly, Va., may fail to meet the needs of jet operations for which it was designed.

ALPA spokesmen were particularly critical of an announcement last week by the Department of Commerce that 1,400 additional acres of land had been purchased to install dual east-west runways. The runways will be shifted 20 deg. to the north to take advantage of prevailing wind velocities. Asserting that their studies indicate winds in the area generally come from either a direct northwest or northeast direction, representatives of the pilot's organization contend the east-west runways should be shifted further to a reading of between 300 and 310 deg. and the north-south runways 15 to 20 deg. to the northeast. Failure to do so, they contend, will subject jet aircraft to "hazardous" crosswind landing conditions.

USAF Transports

Air Force had a total of 1,113 four-engine transport aircraft as of Jan. 31, according to a USAF report to House Appropriations Committee. The largest numbers of the big transports were assigned to: Military Air Transport Service, 604; Tactical Air Command, 106; Air Materiel Command, 101; Strategic Air Command, 100; U.S. Air Forces in Europe, 72; Air Research and Development Command, 45; Pacific Air Force, 30; Headquarters Command, 22.

No-Show Dispute

Civil Aeronautics Board last week voted not to interfere in the current no-show battle between American Airlines and a majority of carriers fighting to retain possession of reconfimation rulings in the plan.

Complaints against American's filing to substitute a "verification" plan as a result of a May meeting of the Air Traffic Conference were made by Capital, Delta, Eastern, National, Southern and Trans World Airlines, all of which favored retention of reconfirmation past a December 1 deadline voted by ATA. In dismissing the complaints CAB termed the issue a management responsibility but repeated its concern over apparent failure of the industry to extend the no-show plan beyond the December date and urged prompt action to assure continuing effective control of no-shows.

Soviet Translations

Foreign Technical Information Center authorized earlier this year by Congress to provide American science and industry a central source for access to translations of Soviet technical information is now in operation. The center, established as part of Department of Commerce's Office of Technical Services will publish abstracts of all articles appearing in 141 Soviet Technical Journals, translations of important sections of "Referativnvy Zhurnal," the Russian's own abstract journal, and a semi-monthly review of various areas of Soviet science compiled by the Central Intelligence Agency. The center estimates that its volume will average 50,000 abstracts and 10,000 complete translation a year.

Kunzig Appointment

Robert L. Kunzig, administrative assistant to the chairman of the Civil Aeronautics Board, has been nominated by President Eisenhower to become a commissioner of the Foreign Claims Settlement Commission subject to Senate confirmation. Former chief counsel for the House Committee on Un-American Activities during the 83rd Congress, Kunzig has served with the CAB for the past three years. —Washington staff

surface-air
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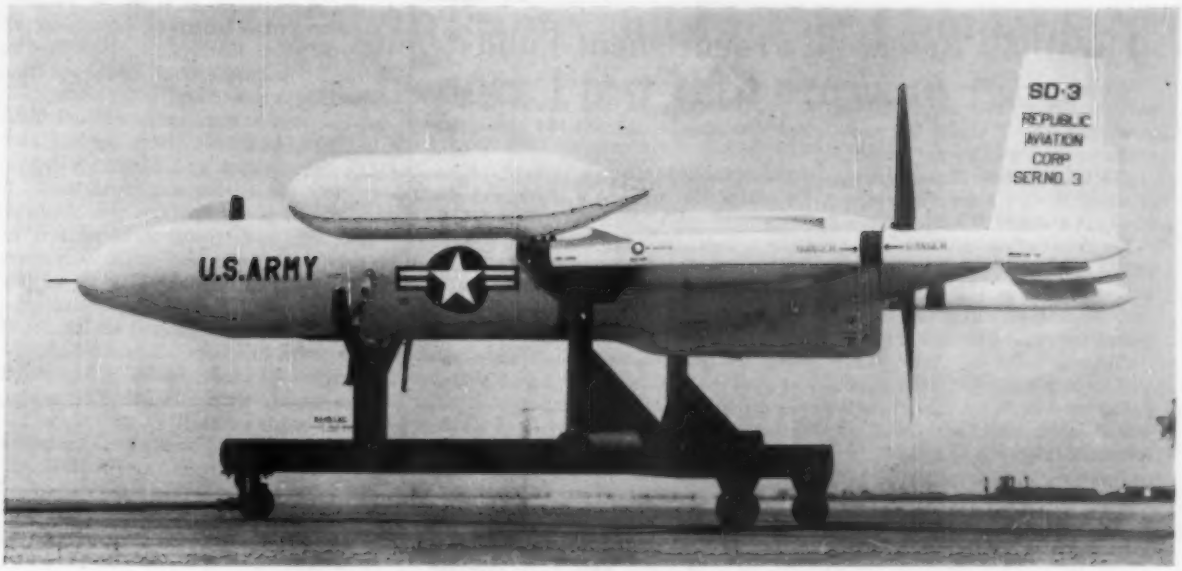


Republic Rolls Out Surveillance Drone

Army SD-3 combat surveillance drone, developed by Republic Aviation Corp., is propeller-driven unit produced for Signal Corps. Drone can be zero-launched and is recoverable. Photo shows profile of first production model at Farmingdale, N. Y. SD-3 has interchangeable noses for taking photographs or sending information to combat operation centers. Company said the drone can report on gun emplacements, troop movements and tank concentrations. Details of control and guidance system are secret.

Space Technology

NASA Budget Cut to $75 Million By Senate Appropriations Group

By Ford Eastman

Washington—Funds requested to get the new National Aeronautics and Space Administration into operation were slashed from $125 million to $75 million last week by the Senate Appropriations Committee.

The Committee in a surprise action reduced salaries and expenses from $7 million to $5 million, research and development from $70.2 million to $35 million and construction and equipment from $47.8 million to $35 million.

Included in the construction and equipment cuts was the elimination of a $3.75 million item for construction of a new Space Projects Center at Beltsville, Md.

In explaining its action the Committee said the $125 million requested plus the $117 million to be transferred to NASA from the Advanced Research Projects Agency in addition to the $294 million to be used by the Defense Department on space projects of a military nature would total $536 million for Fiscal 1959.

The Committee added that it believed it would take time to properly plan for the new agency and therefore recommended the cuts in the budget.

The NASA budget request was attached by the Senate Committee to a supplemental appropriations bill which already had passed the House. If the Senate approves the Committee action, this means the bill would go to conference and conferees could not consider any amount for NASA above the Senate figure since the House did not act on part of the bill.

However, the amount could be lowered or raised by the Senate by rejecting that portion of the Committee report before it goes to conference. Or, if the Senate approves the Committee report in full, conferees could then report the NASA section in disagreement and both Houses would then offer a floor amendment to change the figure.

Surprise Action

The Committee action came as a surprise because of strong congressional criticism against the new agency for not requesting more money. Most outspoken were members of the House Space Committee who said they wanted a program presented which was designed to catch up to and surpass Russian achievements in space technology—not one which would let the U. S. fall further behind.

Other action taken by the Senate Appropriations Committee included:

• **Restored $400,000 to National Science Foundation** salary and expense requests to provide full budget estimate of $4.4 million required to complete funding for the National Radio Observatory at Greenbank, W. Va. The total cost of the project is $9.530 million and includes an 85 ft. radio telescope and a 140 ft. radio tele-

T. KEITH GLENNAN

Bill to Streamline Procurement Proposed

Legislation introduced in effort to cut red tape, speed development, production of weapon systems.

By Katherine Johnsen

Washington—Sweeping procurement legislation to remove red tape and speed the development and production of military weapons was introduced last week by Sen. Leverett Saltonstall (R.-Mass.), former chairman of Senate Armed Services Committee.

The measure evolved from hearings before the Senate Preparedness Subcommittee last January (AW Jan. 20, p. 32) during which aircraft manufacturers and top military officers protested the labyrinthine procedures now in force.

It also reflects the views presented by Dr. Sterling J. Livingston, professor at the Harvard School of Business Administration and president of Harbridge House, which has specialized in defense management studies. Commenting on the bill, Saltonstall said:

"We cannot on the one hand criticize the Defense Department for delays and inefficiency, when at the same time, we impose inordinate administrative burdens through some of our statutes and neglect their modernization."

Key Provisions

Key legislative provisions are:

• **"Competitive negotiation"** would be encouraged. It would be elevated to the legal status of contract by formal advertising. At present, any negotiated contract—competitive or otherwise—requires lengthy justification by the contracting officer as to why it was not let by formal advertising. "Suitable quality" would be given legal weight—as well as cost—in the letting of a negotiated contract.

• **"Performance specifications"** would be authorized, replacing elaborate detailed specifications now required. Saltonstall pointed to "flagrant administrative log-jams such as 18-page specifications which were prepared to describe a ping pong ball." The Saltonstall measure reads that "specifications shall describe property to be procured in terms of functional performance characteristics unless the head of the agency determines that the property will be procured more efficiently by other means."

• **"Fixed-price" or "incentive"** type contracts would be the rule—unless another type contract is specifically authorized by the agency head.

• **Exemption from renegotiation** would be extended to competitive negotiation contracts in which three or more suppliers participated and to incentive and fixed price contracts, as well as contracts let through formal advertising.

"Under the incentive contract, if a contractor effects savings, the bulk of those savings are returned to the government and a small percentage retained by the contractor," Saltonstall noted. "Thus, economy and efficiency are encouraged; but the Renegotiation Board recaptures these added profits, thereby nullifying the incentives to save for the government. Renegotiation sometimes takes five years at great administrative costs to the government."

• **Decentralization of military** supervision of research and development contracts is encouraged. Research and development contracts could provide for the "advisory engineering services of personnel" of the military department letting the contract. The contractor would reimburse the department for the cost of the personnel services. This provision is designed to meet widespread contractor protests against large number of clearances required at the Pentagon or Wright Air Development Center, sometimes by officers or committees unfamiliar with the project details, or lacking in decision-making authority.

• **"Weapon system" procurement** concept is expanded to all major military operational systems. The assignment of design, development, and production of an entire weapon system to a single prime contractor, Saltonstall declared, has resulted in "speed, efficiency, and lack of duplication." The military department letting the prime contract would designate a "system manager" to "exercise supervision and control over, and be responsible for, the procurement" of the entire weapon system.

Saltonstall emphasized that the future security of the U.S. may "depend almost entirely on our ability to produce military hardware in new technological fields at least as fast as the Russians could do so."

He protested "the requirements for contractors to submit every minute engineering detail to scores of offices and committees, while overhead costs mount and essential defense jobs are delayed." Under his proposal, Saltonstall pointed out that "adequate authority would be delegated with responsibility. . . . With the removal of many unnecessary, time-consuming and expensive technical and administrative requirements, he would release the great energy of American industry and consolidate authority with responsibility."

Saltonstall urged a complete investigation of defense procurement between now and next January, preparatory to the consideration of new legislation promptly after the new Congress convenes. In addition to his post on the Armed Services Committee, Saltonstall also is a high-ranking member of the Appropriations Committee and the Small Business Committee and the Senate Republican Policy Committee. He has been a leading Administration spokesman on a large number of defense matters.

Small Business Role

Each prime contract under the bill would provide for "full and free competition" for subcontracts with "preferential" treatment "to increase the participation of small business concerns."

Small businesses and the Senate Small Business Committee have opposed "weapon system" procurement.

Saltonstall called for "a new and realistic" approach to the problem of small firms in obtaining defense business. He commented:

"As weapon systems become more complex, small business has less opportunity to participate in prime contracts. If major prime contractors are required to use government procurement procedures with respect to small business contracting, the ultimate share of Defense Department procurement dollars which end up in the hands of small business will increase rather than decrease."

The underlying policy of the Saltonstall legislation—decentralization of authority and responsibility both in the military and in industry—has been advocated in congressional testimony by USAF Assistant Secretary for Research and Development Richard Horner, Navy Assistant Secretary for Air Garrison Norton and Army Director of Research and Development William H. Martin (AW July 21, p. 26).

Dr. Paul Foote, Assistant Secretary of Defense for Research and Engineering, however, has insisted on the necessity of close "higher control" (AW July 28, p. 28).

Commenting that the military services reflect the view of their contractors, Foote told the House Government Operations Committee:

"Contractors make the point—and they are very emphatic about it—that 'you give us the responsibility for doing this and you need not worry because we will take care of it.' . . . It is absolutely essential that we bring all these competing agencies together and discuss their relative merits. That is what they are objecting to. They do not like it."

Competing team for Dyna-Soar production is headed by Boeing Airplane Co., General Electric Co., Ramo-Wooldridge Corp., Autonetics and Missile Development Divisions of North American Aviation Inc., Chance Vought Aircraft, Inc. and Aerojet-General Corp.

Boeing has formed a systems management office, an organization to develop and provide over-all management for projects employing space age techniques. This office has not yet been specifically referred to as a Dyna-Soar management organization, however.

Dyna-Soar development is being directed by USAF and National Advisory Committee for Aeronautics. In approximately a year, one team's design will be chosen for production.

Extensive teamwork already under way indicates that the six-company Martin team might be considering making other joint proposals rather than anticipating a break-up of the team at the end of the Dyna-Soar competition.

Team system is an outgrowth of the weapon systems concept, but it represents a large step beyond the looser grouping of contractors associated with previous weapon systems efforts.

Trimble said the companies "banded together because of the realization that no single manufacturer can muster all the highly-specialized scientific, engineering and manufacturing skills and facilities required for Dyna-Soar's successful development."

Trimble said most members of the Martin group have been developing phases of Dyna-Soar for a year and a half. "The progress made so far has demonstrated that effective and enthusiastic coordination can be achieved by such a team without a major shift of personnel or abrogation of team member identity of individual company policy," he said.

Bell's Role

Bell's large role in the Dyna-Soar development is based on its experience with the X-series aircraft and its long advocacy of the orbital bomber concept. Bell will design and build the aircraft portion of the vehicle.

Martin will establish configuration and design of rocket boosters—undoubtedly modified Titans—and will carry out an experimental aerodynamic program for the complete vehicle and assemble a full-scale mockup.

Bendix will work on communications systems, telemetry systems, hydraulics, electrical power conversion, cabling and electric connectors.

Goodyear will develop the crew-escape capsule system and radar system.

Minneapolis-Honeywell will develop guidance and navigation systems.

American Machine and Foundry will design and manufacture ground handling and launching equipment.

Airframe and Engine Companies Report First-Half Income Figures

New York—First half reports of most major airframe and engine companies were out by last week and the over-all results presented a mixed picture—some showing good gains, others declines.

Continued pressure on profit margins is becoming a fixture in the industry (see table). Not all profit margins declined, but the declines outnumbered the gains.

Development costs, especially for commercial programs, were a drag on profits, notably in the case of Fairchild Engine and Airplane Company—Grumman Aircraft Engineering Corp. and General Dynamics Corp.—and United Aircraft Corp.

Lockheed Aircraft Corp. on the other hand, reported decreasing write-offs for its turboprop Electra transport. This and added missile business produced record first half sales for the company of $465,735,000 and a 29% increase in earnings from $7,570,000 last year to $9,743,000 this year. First half sales last year were $425,067,000.

Lockheed President C. S. Gross told stockholders the company was encouraged by its ability to bring in new business at a time of widespread change and uncertainty in the industry.

Engineering development expense, particularly for such facilities as Pratt & Whitney's new Florida Research Center, cut United Aircraft's first half earnings even though sales increased from $604,014,634 last year to $635,808,103 this year. Net income declined from $25,747,810 last year to $22,377,699 for the first six months this year.

Expenses of its two new divisions—missiles and space systems and the Norden division—also were a factor and the report pointed out the possibility that the Norden division may require a new facility for engineering and production.

Sales for the rest of the year are expected to remain at current levels but lower earnings were forecast because of continuing development expenses. However Pratt and Whitney has begun deliveries of jet engines for commercial transports and increased deliveries of them in 1959 are expected to help earnings.

Boeing Airplane Co. also reported a first half sales record, a total of $860,753,438 compared with $651,890,419 last year. Net earnings of $19,572,367 for the first half this year compared with $16,502,200 last year.

Unfilled orders, Boeing reported, were $2,825 million, of which orders for 184 commercial jet transports amounted to $861 million.

General Dynamics blamed a slight decrease in first half earnings from $20,336,958 last year to $20,051,967 this year—to write-offs for its commer-

Airframe Companies Report on First Half

	First Half 1958			First Half 1957		
	Sales	Earnings	Profit Margin %	Sales	Earnings	Profit Margin %
Beech*	74,127,779	2,478,019	3.2	75,690,095	2,447,894	3.2
Bell	100,757,151	2,175,703	2.1	103,349,885	2,121,645	2.0
Boeing	860,753,438	19,572,367	2.2	651,890,419	16,502,200	2.5
Chance Vought	153,838,946	4,748,226	3.0	86,044,763	2,125,989	2.2
Douglas	593,974,000	12,645,000	2.1	565,580,000	16,674,000	2.9
Fairchild	67,801,000	5,003,000	(D)	80,366,000	432,000	.05
General Dynamics	789,746,539	20,051,967	2.5	743,711,399	20,336,958	2.7
Grumman	107,532,602	1,030,804	0.9	90,603,052	2,123,469	2.3
Lockheed	465,735,000	9,743,000	2.1	425,067,000	7,570,000	1.66
Martin	188,225,985	3,590,271	1.9	209,381,243	4,425,932	2.2
McDonnell†	442,408,483	10,028,577	2.2	.....	.....	..
North* American	678,879,646	18,223,000	2.68	937,095,267	26,604,000	2.7
Piper*	20,245,210	1,601,571	8	21,523,508	2,420,026	11
Temco	61,519,718	1,177,438	1.9	61,640,181	1,017,758	1.6
United Aircraft	635,808,103	22,377,699	3.5	604,014,634	25,747,810	4.1
Vertol	21,081,260	185,021	.88	41,952,442	1,322,079	2.4

* Third quarter. † Full year. (D) Net loss.

Fiscal '59 Research, Procurement Funds

Washington—Defense Department budget requests for Fiscal 1959 approved by both the House and Senate (AW Aug. 11, p. 26) will give the three military services more than $2.062 billion for research and development and $11.184 billion for procurement of missiles and aircraft.

The total Defense Department appropriations for 1959 amount to $39.6 billion of which the Air Force will receive $17.8 billion, the Army $8.9 billion and the Navy $11.3 billion.

For research and development, Air Force will receive $743 million, the Navy $821.2 million and Army $498.7 million. This represents an increase over Administration requests of $15 million for the Air Force and $71.2 million for the Navy. Army requests remained unchanged. Total research and development funds appropriated for Fiscal 1959 exceed the amount appropriated in 1958 by $444 million.

Congress voted the Army $1.669 billion for procurement of equipment and missiles for Fiscal 1959, $446 million more than the Administration request.

For the Air Force, $6.643 billion was appropriated for aircraft, missiles and related procurement, an increase of $236 million over what was requested by the Administration.

The Navy will receive $2.033 billion for aircraft and related procurement, which is $56 million less than Administration requests, and $837.8 million aircraft and facilities, $6 million below requests.

In the Office of Defense Secretary, the Advanced Research Projects Agency will receive $520 million for salaries and expenses, the same as that asked by the Administration.

scope with highly specialized electronic instruments.

• **Agreed with the House in providing** $2.5 million to complete the funding of the U. S. International Geophysical year program. This is a reduction of $450,000 from the amount requested.

Meanwhile, formation of the new National Aeronautics and Space Administration (AW Aug.11,p.18) moved closer to reality last week with Senate consideration of T. Keith Glennan as administrator and Hugh L. Dryden as deputy administrator.

Following Senate confirmation of appointments, NASA will come into existence when the administrator announces by proclamation published in the Federal Register that the administration has been organized and is prepared to discharge the duties and exercise the powers conferred upon it by the act.

At that time, the National Advisory Committee for Aeronautics now headed by Dr. Dryden will cease to exist, and its functions and personnel will be transferred to the new agency.

The nomination of Glennan, now president of Case Institute of Technology, Cleveland, Ohio, was met with mixed reaction in scientific circles and in Congress, primarily because of the hope in some quarters that Dryden would be named to the top post.

At the same time, however, it was felt that Glennan's record in business, education and the administration of scientific research represent adequate qualifications for the position.

Glennan, 52, a native of Enderlin, N. D., became president of Case Institute in 1947 and, during his administration, the institution was transformed from primarily a local school to a leading engineering school. During his presidency, he served two years —1950 to 1952—as a member of the Atomic Energy Commission.

Currently, Glennan is a member of the board of the National Science Foundation, chairman of the board of the Institute for Defense Analysis, a member of the board of directors of the Council on Financial Aid to Education and a member of the General Advisory Committee of the AEC.

In Cleveland, he has served as chairman of the Metropolitan Services Commission and as a trustee of the Cleveland Clinic Foundation.

In the business field, Glennan is a member of the boards of the Cleveland Electric Illuminating Co., the Clevite Corp., Standard Oil of Ohio and the Harris-Intertype Corp.

The new administrator entered Yale in 1924, graduating from its Sheffield Scientific School in 1927 with a degree in electrical engineering, cum laude.

Following graduation, he became associated with the motion picture industry and spent two years in Europe supervising the installing of sound systems. Later, he became assistant general service superintendent for Electrical Research Products, a subsidiary of Western Electric. In 1935, he joined Paramount Pictures Inc., becoming studio manager in 1939.

Glennan served briefly as an executive with Vega Airplane Corp. in 1941 and then became studio manager for Samuel Goldwyn Studios.

In 1942, he joined the Columbia University Division of War Research, serving first as administrator and then as director of the Navy's Underwater Sound Laboratories at New London, Conn.

After the war, Glennan became an executive of Ansco Corp., Binghamton, N. Y., until he left to become president of Case.

Dr. Dryden has been head of NACA since 1947, during which time the organization has made many outstanding contributions in the aeronautical research field. Previously, Dryden had served with the National Bureau of Standards, joining the organization as a physicist in 1918 and becoming head physicist in 1938. He holds bachelor, master and doctor of science degrees from Johns Hopkins University, Baltimore.

Space Technology

Martin Organizes Space Division

Washington—Important step in industry's evolution to meet the space age has been taken by the Martin Co., which has created a Space Flight Division to direct a six-company team developing the USAF Dyna-Soar orbital bomber.

Unusual management features include:

• **Division, located in Baltimore, Md.,** is staffed by both Martin and Bell Aircraft Corp. personnel.

• **Presidents of the six companies form** a special consulting and advisory board for the project.

Division already is in operation. George S. Trimble Jr., former Martin vice president for engineering, is vice president and the division's general manager. Assistant general manager is Roy J. Sandstrom, Bell vice president who is director of satellite and space vehicle activities for Bell's Niagara Frontier Division. A number of other Bell personnel already are located in Baltimore.

This close alliance is the strongest manifestation so far of an increasing trend (AW June 16, p. 93) toward associations of contractors formed for specific projects that is resulting from the shrinking number of weapon systems and increasingly higher costs and technical complexity.

Martin and Bell are joined by Bendix Aviation Corp., Minneapolis-Honeywell Regulator Co., Goodyear Aircraft Corp. and American Machine and Foundry Co. in the Dyna-Soar competition.

ders list for the North American B-70 and F-108, which will have performances in this region.

• **Higher performance version** of the Corvus air-to-surface missile under budgetary study by the Navy.

• **Iconarama** an automatic multichannel two-or-three-dimensional plotter for traffic control and missile range use. The device, which converts radar signals into a continuous trace plot, is an off-the-shelf item and has been delivered to Patrick Air Force Base, Fla., the White Sands Proving Ground and the Navy's Pt. Mugu, Calif., range for monitoring range traffic.

Talos Scores Kill On Kingfisher Drone

Los Angeles—An Army Talos guided missile registered a kill against a Lockheed Kingfisher ramjet target missile which achieved supersonic speed after being launched from a Boeing B-50 above White Sands Missile Range, N. M.

Radar data on altitude, speed and course was fed into the Talos defense unit search system.

Lockheed firing error indicator in the drone, basically an X-7, transmitted data to a ground receiving station indicating that a hit had been scored.

Kingfisher is equipped with a radar target augmentation device to enable the target to simulate a number of aircraft and missiles. Drone also is equipped with a nose spike to facilitate recovery.

Bendix is prime contractor for Talos.

Thor Delivered To Cooke AFB

First Thor intermediate range ballistic missile to be delivered to Cooke AFB for use in various training programs and in evaluating test stands and firing equipment arrived there last week. Shrouded Thor, resting in horizontal position in transporter-erector, was trucked along Pacific Coast highway by a standard truck-tractor towing the transporter, while a helmsman steered the rear wheels of the mobile ground support equipment. Trip of 160 mi. from Santa Monica to Cooke AFB took 12 hr.

Norway Inaugurates NATO Radio Network

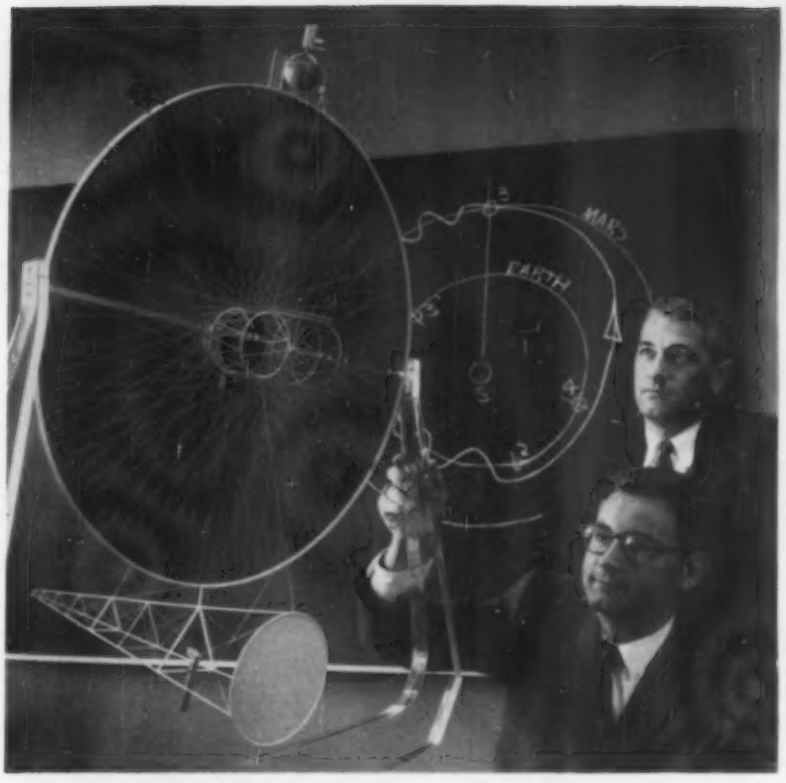
Paris—First section of NATO's new "forward scatter" communications system has gone into operation in Norway. Norwegian link is first step in a program which will connect NATO commands from Norway to Turkey. Use of forward scatter system, NATO says, promises a military communication system which is "nearly jam-proof."

Technique involves use of UHF radio signals transmitted at much greater power than used by conventional UHF sets. Signals are beamed at a pre-selected tropospheric or ionospheric layer which reflects small portions of the radio energy back to earth at pre-determined points.

System is being installed throughout NATO area under the supervision of International Standard Electric Corp., New York City, and Hycon Eastern, Inc., Cambridge, Mass. These two firms were given an $8.5 million contract by NATO in May, 1957.

Norway was selected as first link partially because its geographic configuration made possible operation of a complete link in one country, rather than starting initially with several countries. Four stations are used in the Norwegian setup, at Trondheim, Mosjoen, Bode and Oslo, the latter city being headquarters, Allied Forces Northern Europe.

NATO has not revealed where its second link will be added, nor has a completion date or cost for the entire system been fixed. NATO has said that under the new system only 250 operators will be needed for all of Europe. Using the troposphere, messages can be transmitted up to 250 mi. If need be, the system can utilize the ionosphere to transmit messages up to 1,300 mi.



Boeing Proposes Mars Vehicle

Scale model of space vehicle to make close-up studies of the planet Mars is inspected by Boeing Airplane Co. Scientists Richard D. White (standing) and Henry K. Habeler, vehicle designers. Full-sized vehicle would be 40 ft. wide and would weigh 600 lb. Assembly and launching would be from satellite station at least 400 mi. above the earth. Power would come from the sun and vehicle would orbit Mars in three years and then return to the platform. An advanced optical system would observe surface of Mars and relay data to earth. Guidance would be by built-in memory, corrected as necessary by star tracking system. Thrust would be provided by ion accelerator.

Ford Instrument Gets Navy Computer Award

Washington—Navy has awarded Ford Instrument Co., a division of Sperry Rand Corp., a $7.4 million contract for production of guided missile computers to calculate a surface-to-air missile's trajectory in relation to approaching aircraft.

The computing equipment, will be used by Navy aboard missile cruisers and destroyers now under construction which are scheduled to carry the Tartar guided missile.

cial jet program. Sales increased from $743,711,339 last year to $789,746,539 this year.

Grumman's expenses on the Gulfstream turboprop executive transport and other projects, a total of $5,325,000 in the first six months of 1958 cut earnings of $1,030,804 compared with $2,123,469 last year. Sales increased to $107,532,602 for the first half this year as against last year's $90,603,052. Grumman said the high outlays would continue through this year.

Because of its F-27 Friendship costs (AW July 28, p. 31), Fairchild's first half loss amounted to $5,003,000 on sales of $67,801,000.

This compared with earnings of $432,000 on sales of $80,366,000 for the first half last year.

Some Airlines' Earnings Decline

Washington—United Air Lines last week reported a net profit of more than $4 million for the first six months of 1958 as compared with $1.4 million for the same period of 1957.

Profits from the sale of aircraft brought the net earnings total to $4,139,514 for the first half of the year, while aircraft sales added $1,549,634 to net earnings for the same period of 1957. Operating revenues for the period totaled $148 million, reflecting an 11% gain over last year's figure for the period. Operating expenses increased 8% for the first six months of the year, representing a cost of $139,356,258.

Other carriers indicated less important gains or poorer net results than in first-half 1957. They included:

• **Eastern Airlines announced** a net profit of $4.9 million as compared with $5.3 million for the first six months of last year. Operating revenues for the airline totaled $139.9 million, or 1.2% above last year's figure, while operating expenses decreased by 0.1% to $129.8 million in this period.

• **Capital Airlines** reported a net loss of $728,611 during the first six months of this year as compared with a loss of $769,941 for the same period in 1957. Operating revenues of $50 million reflected a gain of $6 million over the first six months of last year. Operating expenses of $49.7 million represented a cost increase of $6 million over the first six months of last year.

• **Braniff Airways** reported a net profit of $870,869 for the six months ended June 30, a 4½% gain over earnings of $831,200 for the same period of 1957. Operating revenues for the period were $33.2 million, as compared with $30.2 million for the first half of 1957. Operating expenses of $31.8 million for the first six months of this year were approximately $3.4 million above those of the same period in 1957.

• **Northwest Orient Airlines** recorded a net profit of $521,713 for the first six months as compared with $908,545 for the same period of last year. This year's figure includes $429,479 income from property disposal as compared to more than one million dollars realized from the sale of aircraft during the first six months of 1957. The carrier's operating revenues for the 1958 period were $44 million reflecting a 15% increase over the six month period last year.

• **Continental Air Lines** reports a net loss of $515,827 for the first half of this year as compared with a net profit of $43,416 recorded for last year's period. Operating revenues for the airline increased 19% to a new high of $12.2 million for the first six months of this year over the $10.2 million recorded for the same period of 1957. Operating expenses, however, increased 28% with a total of $12.5 million for the first half of this year.

• **Seaboard & Western Airlines** had a net loss of $1,223,269 for the six-month period of this year as compared with a profit of $661,779 for the first half of 1957.

• **KLM—Royal Dutch Airlines** reported a net loss of $627,000 for the first six months of this year as compared with a $2 million profit listed for the same period of 1957. Operating revenues decreased $1 million during the first half of this year from the $61 million recorded for the first six months of last year. Operating expenses for the foreign carrier were $64.8 million as compared with $59.7 million for the first half of 1957.

• **Delta Air Lines** in a preliminary report to its stockholders announced a net profit of $1,063,155 for the fiscal year ended June 30 as compared with a profit of $2.6 million last year. Total operating revenues for the fiscal year were $88.1 million as compared with $78.5 million operating expenses for the previous year.

F-104 Grounded

Lockheed F-104 fighter aircraft were grounded last week by the Air Force so that changes can be made in the J79 fuel and temperature controls and in the afterburner nozzle control. Air Force officials would not comment on any possible connection between the groundings and F-104 crash several weeks ago that took the life of Capt. Iven Kincheloe (AW Aug. 4, p. 34). Investigation of the accident is still in progress.

Tighter Scheduling Cuts Temco Costs

New York—Temco Aircraft Corp. in a search common to the entire industry, to cut costs, will save about $700,000 in interest charges this year through tightened inventory control and scheduling, Temco President Robert McCulloch told the New York Society of Security Analysts here last week.

Temco will process $20 million less of material in 1958 than it did last year, McCulloch said, because the trend today is for high quality, low weight products, products that require the application of more skilled labor and less material than in the past.

Because of the closer scheduling of suppliers and movement away from the practice of buying large quantities of material for long production runs, Temco will turn over its inventory four times this year, McCulloch said.

By carrying smaller inventories, Temco was able to reduce its bank loans from approximately $15 million to $4 million with the resultant saving. Competition is growing increasingly intense, McCulloch said.

"Competition is no longer confined to the people we are accustomed to bidding against," he said, "but now the large prime contractors are bidding right along side of us. There are obviously many desperation bids being submitted against which we do not have a chance, and, of course, we have no desire to be kin to the cartoon character I am sure many of you have seen depicting the tattered tramp bearing the slogan, I was the low bidder."

In the first half of 1958, Temco bid on 90 proposals, won 21. McCulloch said this was a pretty good batting average, comparatively. The company now is working on 23 proposals for contracts to be awarded by the year end.

McCulloch estimated Temco sales by 1961 would be half airframes and half missiles and avionic gear. He estimated 1958 total sales at $120 million and the breakdown at $82 million manufacturing subassemblies for others, $18 million for IRAN and $20 million in missiles and avionics.

Major subassemblies include:

• **Boeing B-52G** aft section (58 ft.).
• **McDonnell F-101** aft section and photo nose.
• **Lockheed F-104** wings.
• **Raytheon Hawk** wings.
• **Lockheed Polaris** engine casings, supplied to Aerojet-General.

New products and techniques Temco has developed include:

• **Method to braze** stainless steel honeycomb sections in double curvature with possible uses for Mach 3 aircraft. Temco has been included on the bid-

University of Iowa scientists have analyzed the data from several hundred over-station passes (not complete orbits) made thus far and say all the data has been extremely "self-consistent." This convinces the scientists that their instruments are accurately reporting what they are finding in space.

Data analyzed to date has not been sufficient to establish the relationship of radiation intensity to latitude and longitude except to suggest that radiation is not symmetrical with respect to either.

Explorer IV data also indicates that the radiation is not isotropic—that is, it is not equally intense from all directions.

This has been established from the two-to-one variation in the scintillation counter's counting rate as Explorer IV tumbles propeller-fashion in its orbits. However, there is no way of establishing what direction Explorer IV's scintillation counters are pointed at the instant of maximum intensity.

Explorer IV data is being transmitted simultaneously by two transmitters. The Navy Minitrack transmitter, operating at 108.03 mc. puts out about 25 milliwatts. Army Microlock transmitter operating at 108 is rated 10 milliwatts. Both are expected to operate for approximately two months on their batteries before going dead.

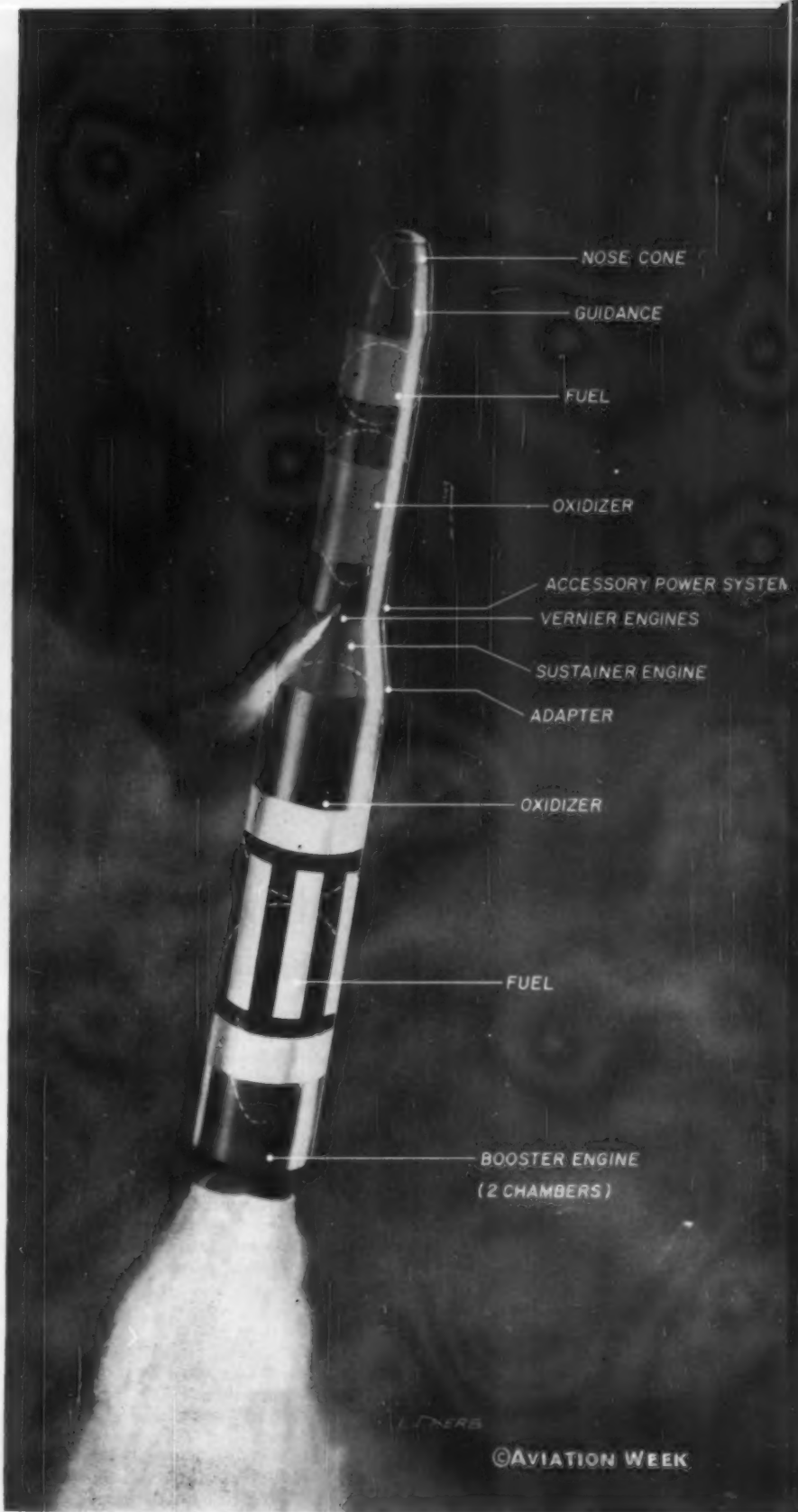
Despite the fact that Minitrack transmitter is operating at lower power level than in Explorers I and III, it has been giving much better performance. In earlier satellites, ground stations were able to obtain telemetered data for about two to five minutes as satellite came near, whereas Explorer IV is providing a usable signal for 5 to 10 min., according to Ludwig.

Westinghouse Given Shelter Contract

Westinghouse Electric Corp. has received purchase orders from Douglas Aircraft Co. for approximately $1.7 million in electrical equipment to power retractable shelters for Douglas' Thor intermediate ballistic missile.

The shelters will completely enclose the missile plus its launching mechanism, both of which will be positioned horizontally on the firing pad. When prelaunch preparations are complete, shelter can be rolled back its full traveling length to permit the Thor to be erected vertically on the firing pad.

As part of the order, Westinghouse will manufacture motors and control equipment at its Buffalo, N. Y., plant; gear units at its Nuttall facility in Pittsburgh. The electrical units will be assembled at the company's manufacturing and repair facility in Compton, Calif.



AVIATION WEEK artist's conception of USAF-Titan 5,500 mi. missile now in handling and checkout tests at Cape Canaveral, Fla. External configuration is not classified. First firing of 90-ft., two-stage missile is due in October (AW July 21, p. 19).

Space Technology

Radiation Poses Manned Space Problem

By Philip J. Klass

Iowa City, Iowa—Three basic questions upon which the whole future of manned space travel may depend have been raised by the extremely intense radiation discovered by Army's Explorer III and confirmed with the addition of important details by recently launched Explorer IV (AW Aug. 11, p. 20). They are:

- **Radiation depth.** Does extremely intense radiation extend out into the solar system indefinitely or only near the earth? Earlier, it was thought that radiation might be found within a thin belt which could be quickly penetrated by space vehicles; now, scientists find that the radiation extends at least to 1,200 mi. with no sign of falling off.
- **Radiation gradient.** Explorer IV data analyzed to date reveals that intensity of radiation doubles approximately every 60 mi. beginning about 250 mi. up. Important question is whether it continues to build up at the same rate.
- **Type of radiation.** Originally, scientists suspected that radiation was due to electrons, which are only about 1/10th as lethal as protons. Explorer IV data raises the suspicion that radiation comes from more lethal particles.

University of Iowa scientists headed by Dr. James Van Allen are preparing new instrumentation packages for Explorer V and other Army space probes to obtain additional pieces of information about the nature and depth of the radiation.

If the radiation extends indefinitely out into space and if it continues to double in intensity every 60 mi. and if it consists of protons or other nucleon particles instead of electrons, the space traveler is in for a lethal trip unless the vehicle carries a huge amount of shielding.

For example, data analyzed by University of Iowa scientists reveals that scintillation counters in Explorer IV at 1,200 mi. altitude were exposed to a minimum of 10 roentgen per hour if radiation is electrons, 100 roentgen per hour if radiation comes from protons.

Radiation Dosage

According to Atomic Energy Commission figures, a person exposed to a total of 450 roentgen has only a 50-50 chance of living through the next 30 days.

The AEC recommended that a maximum safe weekly dosage is only 0.3 roentgen.

Early post-Explorer III speculation that light lead shielding might prove sufficient to protect the space traveler has been shattered by Explorer IV which carried two Geiger counter tubes, one of them shielded with ⅛ in. of lead. At low altitudes, the lead-shielded counter experienced only 60% as many penetrations as the unshielded one. But at higher altitudes and radiation intensities, the shielded counter experienced practically as many penetrations as the unshielded one, according to Carl McIlwain of the University of Iowa Physics Department.

Intense radiation, if it extends for any great distance beyond the earth, may eliminate the possibility of obtaining usable photographs during a lunar probe, since film would be completely fogged by the radiation.

Limited to small instrument payloads, Iowa University scientists are proceeding with modest experiments aimed at slowly eliminating presen' unknowns, according to George Ludwig, a member of Van Allen's group. For example, one of the scintillation counters in the Explorer V package is being modified to make it insensitive to electron radiation but without dulling its sensitivity to protons or other nucleon particles. If this scintillation counter records essentially the same number of radiation penetrations as Explorer IV, scientists will know the radiation is predominantly protons or other heavy particles.

Once it has been established whether the radiation comes from electrons or from heavier particles, scientists will then be able to determine the average energy level of the radiation, utilizing the ratio of penetrations experienced by the shielded and unshielded Geiger counters which will be carried in Explorer V as well as in Explorer IV.

In subsequent space probes, scientists expect to substitute ion chambers for the Geiger counters in order to measure the ionization rate of the radiation, which is a direct measure of the biological hazard involved for space travelers.

Other Detectors

If earlier tests show the radiation is not from electrons, subsequent experiments will use different types of detector elements in the scintillation counters in order to establish whether the heavy particles are protons, Alpha particles or other nucleons.

Each new bit of data, like another piece in a jigsaw puzzle, will enable scientists to further narrow down their search for the basic nature and source of the radiation.

The answer to the important question of how far the radiation extends into space may come when the Air Force or Army launch one of their lunar probes, or earlier if Army decides to try for an extremely high apogee, highly elliptical satellite orbit like that of Explorer III.

Soviet Radiation Findings

Moscow—Cosmic radiation findings made with Soviet Sputniks agree closely with data collected by U. S. satellites and indicate that Russian instruments are of high quality.

Professor Sergei N. Vernov, reporting at the recent International Geophysical Year meeting, told of measurements of considerable cosmic radiation increases at certain times and locations. One increase in intensity of 50% in seven minutes was measured by two counters on Sputnik II in 50 deg. N. latitude last Nov. 7, Vernov said.

Cause of the surge has not been determined, suggesting it might be due to an increase in electron flux within the earth's field rather than an increase in primary cosmic radiation.

Scintillation counters on Sputnik III registered high intensity of protons in the same region where the November burst was observed, Vernov said. He said findings indicate stationary electron currents at high altitudes, a fact already reported by U. S. scientists. Vernov said "a large number of secondary particles accumulate near the earth and make periodic movements from one hemisphere to the other, with magnetic movement remaining constant."

Two suggestions were made on the origin of low energy radiation near the earth:

- Decay of neutrons resulting from cosmic rays striking the atmosphere, with secondary products diffusing out and neutrons decaying into protons plus electrons with a half-life of 13 min.
- Electrons from the sun arriving in clouds of gas.

Vernov suggested similar low energy radiation may be expected in the neighborhood of other planets.

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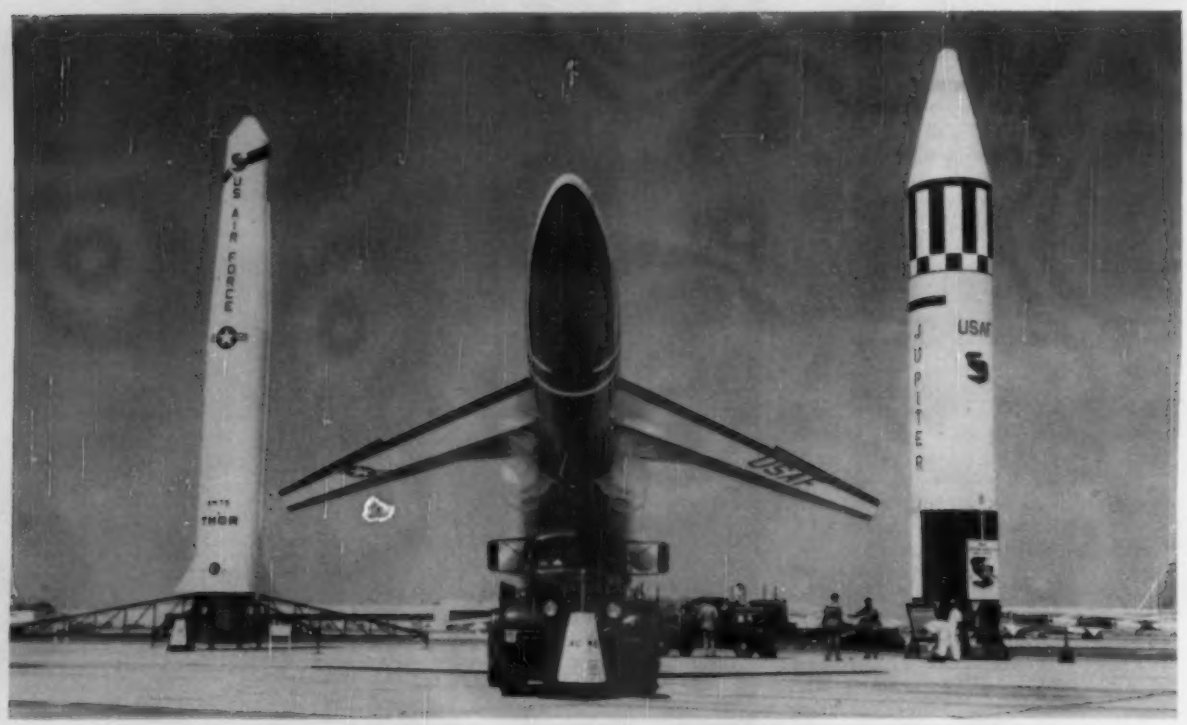

SAC Missiles on Display

Two U. S. Air Force Strategic Air Command intermediate range ballistic missiles, Thor (left) and Jupiter (right) are shown with Snark surface-to-surface missile, at center. Army-developed Jupiter is in 1,500-2,000 mi. category, as is the Thor. Snark has nuclear capability and can travel 5,500 mi.; powerplant is Pratt & Whitney J57 turbojet engine.

Space Technology

Satellites Not Missile By-Product, Jet Propulsion Laboratory Says

By Russell Hawkes

Pasadena, Calif.—Satellites and missiles should be closely related technically and organizationally but satellites must not be regarded only as missile program by-products, reserve officers attending an Office of Naval Research Seminar here were told. Eberhardt Rechtin of Jet Propulsion Laboratory, California Institute of Technology, was the speaker. His conclusions were drawn from a Jet Propulsion Laboratory study for Army Ordnance Corps.

Arguing that satellite development should not be segregated from missile programs, Rechtin pointed out that reliability of a device is largely dependent upon familiarity with it. At least until recently, only the military has had sufficient funds to perform the large number of tests which provide this familiarity.

Among the lessons to be learned by satellite agencies from past missile programs is the curious fact that the final degree of success of a missile program can often be detected quite early in its development. If a missile program starts well, it generally ends well. If it starts with failures, it is rare that a successful missile is ever produced.

One possible explanation is that the failing program took on more than it could handle. Another is that reliability is strongly dependent upon good management which is reflected in good missiles, while bad management leads to unreliability.

Missile programs can also teach satellite builders something about estimating the date on which the research development phase of a program is complete. Dr. Louis G. Dunn, former director of Jet Propulsion Laboratory, once said of the Corporal program that development would be complete when three consecutive missiles had landed within one circular probable error of the target.

Rechtin says that in many missile programs a strong correlation has been apparent between the three-in-a-row criterion and the point at which, in retrospect, the research and development phase has ended.

Rechtin also pointed out that experience indicates that a missile cannot be regarded as a true weapon until it has undergone from two to three years of firing by military personnel.

Rechtin cited negative lessons to be learned from missile experience. He said, "apparently, it is possible to delude one customer for a considerable length of time by presenting a series of more and more glorious proposals based upon earlier proposals, none of which are even out of the research and development woods.

"What seems to be still worse, it is possible to come up with phantom manpower for these jobs by saying, as each new proposal is presented, that the manpower is now available because the previous proposal-program is now well under way.

"It is worthwhile to compare this shell game with the Russian proposal system. Failure is a dangerous thing in Russia; therefore, some organizations accomplish their work in one year and propose to do it in the next so that by the end of the second year they can always produce success. If parts of their work don't go well, they just don't propose them in the following year."

Rechtin attacked misuse of technic committees. He said that technical

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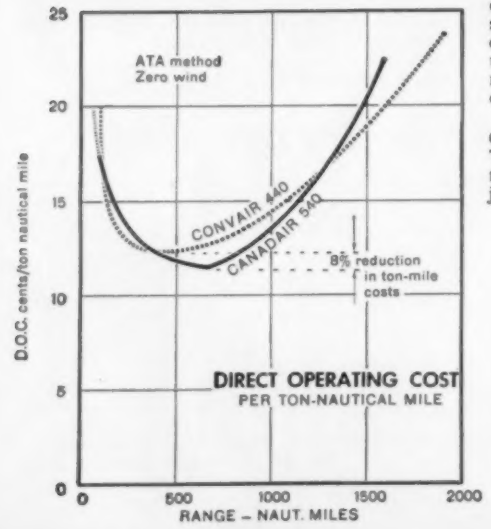
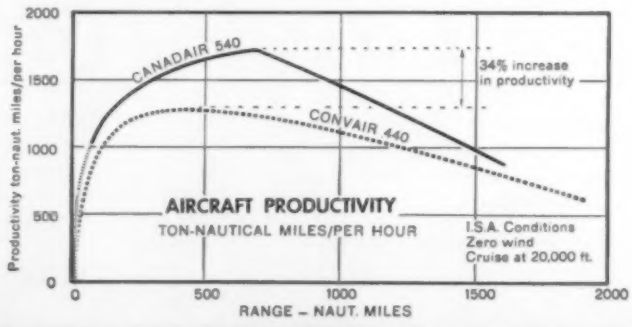


Graph at left, based on the ATA formula, shows that the direct operating costs of the "540" are as much as 8% lower than the "440". This applies particularly on stages over 400 miles; under 400 miles the graph indicates the two are approximately equal. Not reflected, however, are additional reductions in airframe and engine maintenance costs because of the more basic reliability of turbine engines and a minimum of vibration. This makes the "540" more economical than the "440" over any stage length.

Graph below shows the very definite superiority in aircraft productivity of the Canadair "540" over the "440", which is as much as 34% at their optimum ranges. This indicates that for equal annual utilization the "540" could produce 34% more ton miles; or equivalently, the Canadair "540" fleet size required to do the same job could be reduced by 34%, with a consequent saving in capital investment.



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committees are seldom given a chance to serve a useful purpose. "It is a recognized tactic of some officials, government or otherwise, to hand a committee a loaded question in order to absolve the official himself of the responsibility for decisions. This small group is not asked how the job should be done, but whether or not the particular proposal is technically feasible. Obviously, there are a number of technically feasible things which should never be done at all and others which should never be done by the proposing agency.

"Nonetheless, it is extremely rare for a committee to turn down a proposal and instead, suggest that a different concern should be given that job.

"It is still more rare for a committee, asked how a job might be done, to question whether or not the job should be done at all.

"The reason is not that the committee could not consider such possibilities, but rather that it was never asked to do so, and would probably never be used again if it did."

Most technical committees are composed of persons of quite high administrative rank who seldom have more than two days a month for committee work. This situation makes many committees easy marks for the familiar techniques of the "snow job." The committee has little opportunity to absorb the material let alone offer constructive criticism, Rechtin said.

Canada May Choose Primary Jet Trainer

Ottawa—Canada may be ready to choose a primary jet trainer for the Royal Canadian Air Force to replace its present piston engine types, a report of a Canadian House of Commons standing committee on estimates indicates.

The committee recommended replacing the RCAF's de Havilland Chipmunk and North American Harvard (AT-6) trainers with a turbojet powered primary trainer, retaining the T-33 Silver Star as an intermediate trainer. This would eliminate high replacement and maintenance costs of present equipment, the committee said.

Most likely choice would be the Canadair CL-41, (AW Nov. 25, 1957, p. 81) which the company has been developing with its own funds for such use. The committee visited Canadair's plant and was shown the trainer before the report was written.

However the RCAF has looked at various U.S. trainers as well and has given no formal indication of a preference.

The committee also recommended that if the Canadian government went ahead with the Avro CF-105 Arrow production program, some cost sharing agreements should be made with allied nations who could use the supersonic interceptor. By the end of the current fiscal year in March, 1959, Canada will have spent $400 million on this airplane, or about $11 million for each of the 37 test models that have been ordered.

KLM Airliner Down On Atlantic Flight

New York—Wreckage of a KLM Royal Dutch Airlines 1049 Super H Constellation lost last week on the North Atlantic was believed sighted Thursday about 200 mi. west of Shannon. The plane, carrying 99 persons, left Shannon at 11:05 p. m. New York time on Aug. 13 and was last heard from by Shannon 35 min. later.

Air-sea rescue reported sighting the wreckage and several inflated life dinghies but by noon of last Thursday there was no report of any survivors being sighted. Position of the wreckage was 53 deg. north, 12 deg. west.

The flight, an extra section with 91 economy class passengers and a crew of eight, had departed Amsterdam at 6:15 p. m. New York time Aug. 13. Eighty-five of the passengers boarded at Amsterdam and the other six at Shannon. The flight was due at Gander, Newfoundland, for refueling at 7:20 a. m. Aug. 14, and its scheduled arrival at New York was 1 p. m. Shannon declared an alert at 2:08 a. m. At 11 a. m. the airline declared the plane definitely lost, with fuel presumed exhausted.

New Models Highlight Farnborough Show

London—This year's Farnborough Air Show will have a mixture of civil and military aircraft new to the show with established models "for which there exists a steady demand," as the sponsoring Society of British Aircraft Constructors puts it.

Among aircraft being displayed at Farnborough for the first time will be two of special interest in the helicopter field—the Fairey Rotodyne, and the twin-rotored, twin engined Bristol 192 turbine helicopter.

Blackburn NA.39 naval strike bomber will get its first public workout and will probably be flown by at supersonic speeds—as will the Fairey Delta 2, seen at last year's show.

Rolls-Royce Tyne Ambassador will be one of several new engine test beds.

Among other planes on display for the first time: Saunders-Roe P.531 five seat turbine powered helicopter, Westland Westminster utility "flying crane" helicopter, de Havilland Comet 4 and Comet 3B, Handley Page Dart Herald, Auster Alpha, Avro Vulcan Mk2 and English Electric Canberra T.11.

Short SC.1 vertical takeoff research airplane billed as the aircraft which points way to future supersonic airliners—will be shown in the static park, along with some 20 other aircraft including pilotless Canberra drone, Shackleton, Britannia and Sycamore helicopter.

News Digest

Grumman Gulfstream turboprop executive transport made its first flight last week.

Navy has lost five other aircraft besides a Grumman F9F-8P Cougar that crashed into a mountain near Beirut, killing the pilot. These were a McDonnell F3H-2N Demon, a Douglas AD-5N Skyraider and a helicopter from the carrier Saratoga and a McDonnell F2H-3 Banshee and a North American FJ-3M Fury from the Essex. All five were lost in operations at sea, but all personnel were rescued.

English Electric P.1B will be called "Lightning," according to British Air Council.

Vertol Aircraft Corp. plans to rehire 50 engineers as a result of receiving a contract for 10 Model 107 twin turbine helicopters from the Army.

Dr. William F. Durand, 99, one of the 12 original members of the National Advisory Committee for Aeronautics and its World War I chairman, died in New York last week after a short illness. Often referred to as the "dean of American engineering," Dr. Durand had achieved prominence in both naval and aeronautical engineering. In 1941, he was the first recipient of the Wright Brothers Memorial Trophy awarded by the National Aeronautic Assn. for his "significant public service of enduring value to aviation in the U.S." He also had received the Guggenheim Medal "for notable achievement as a pioneer in laboratory research and theory of aeronautics and for distinguished contribution to the theory and development of aircraft propellers." Dr. Durand retired from NACA in 1933 but returned during World War II at the age of 82 to head its special subcommittee on jet propulsion.

Australian Malkara anti-tank guided missiles will be tested on 7,000 acre range on the Solway Coast of Scotland next month. Malkara is 200 lb. ground-to-ground radio controlled weapon.

Congress Approves Federal Aviation Act

Congress passes act establishing independent Federal Aviation Agency; CAA, AMB to be absorbed.

By Robert H. Cook

Washington—Congress last week approved the Federal Aviation Act establishing an independent Federal Aviation Agency with only minor amendments to the administration's original proposal.

The President's approval of the bill will immediately make effective provisions providing for the formation of the new agency and for the qualifications of its first administrator who will be appointed by the White House.

Remainder of the act will become effective 60 days after the administrator takes office.

The agency, which will be responsible for the U. S. airways system, will absorb the Civil Aeronautics Administration and the Airways Modernization Board.

As spelled out in the bill, the FAA Administrator would be responsible for:

- **Development and operation of** a common system of air traffic control and navigation for both military and civil aircraft.
- **Regulation of air commerce** in such a manner as to promote its safety and fulfill the needs of national defense.
- **Promotion and development of** civil aeronautics.
- **Control of airspace and** the regulation of both military and civil flights in the interest of safety.
- **Consolidation of research** and development projects for air navigation as well as the installation and operation of navigation facilities.

Extensive personnel transfers and reassignments from all existing government aviation agencies will become the first task to confront the new agency, according to Elwood Quesada, special assistant for aviation to the President.

Quesada said preliminary plans already are under way to carry out the changeover of duties, with a detailed "manning table" spelling out assignments and qualification expected to be ready within the next three weeks. He particularly emphasized that the personnel shift involves only a realignment of existing duties with no threat of lower job classifications.

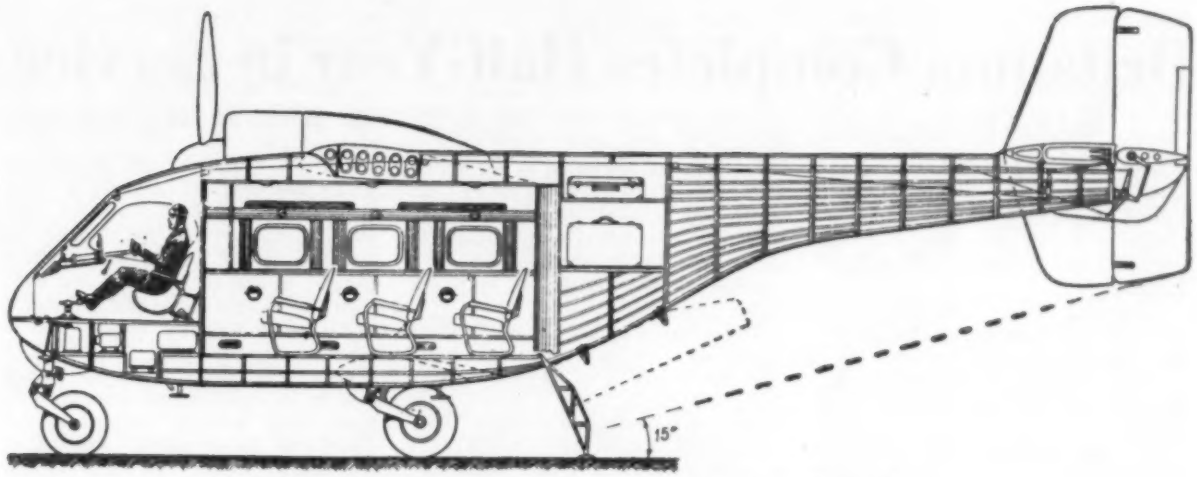
Once the actual working staff has been assembled, FAA can concentrate on the top priorities of developing and implementing improved air traffic control procedures plus an expanded research and development program utilizing current knowledge gained by the Civil Aeronautics Administration and the Airways Modernization Board, of which Quesada is chairman.

While generally satisfied with the bill as approved by Congress, Quesada says that a section, allowing the President to place FAA under the Department of Defense in time of war had caused confusion in some quarters.

The authority, he explained, is permissive language designed as an interim measure to protect military bases from loss of FAA personnel during time of war. In effect, it protects the military from any such loss between the time the agency begins to operate and such time as definite legislation is proposed

How Douglas DC-8, Boeing 707 Compare Head-On

Nose section configuration of Douglas DC-8 (left) and Boeing 707 jet transports are shown above. Two inlets in DC-8 nose are for cabin air supercharger; both aircraft have radar nose sections. Nose wheel fairings doors are extended on Douglas jetliner and closed on Boeing 707. Sound suppressors can be seen on engine tailpipes.



An-14 Drawing Shows Transport Details

Engineering details of Russian Antonov An-14 Little Bee light transport are uncovered in this first drawing. Shown is six-passenger configuration, other models are used for pilot training, agricultural missions, forest patrol and sport activities. Rear door makes Little Bee adaptable to parachute jumping. Plane can be fitted with de-icing equipment and skis for operation in low temperatures and from snow or ice. Latest specifications from Russia show that the plane has a maximum gross takeoff weight of 7,050 lb., wing span of 65 ft., wing area of 470 sq. ft. and is 36 ft. long.

to handle this problem. He added that legislation specially detailing the duties of civilian traffic controllers assigned to military bases in time of war probably will be presented to Congress.

In its final form, the Federal Aviation Act adopts principles of the Air Commerce Act of 1926, the Civil Aeronautics Act of 1938 and the Airways Modernization Act of 1957, all of which –together with any other acts that might conflict–would be automatically repealed upon the effective date of the Federal Aeronautics Act.

The Airways Modernization Board staff and projects would be united with the CAA's Technical Development Center to form a concentrated research and development division.

Civil Aeronautics Board remains relatively untouched by the new act. CAB will retain its authority for economic regulation of the airlines. However, it will lose its power to allocate airspace and authority for the safety regulation of civil aviation. The Board retains responsibility for accident investigations and determination of probable cause.

As reported out by a joint House-Senate conference, the bill calls for a civilian administrator with experience in a field directly related to aviation.

A proviso was added to the effect that if the administrator is a former regular military officer, his deputy should be a civilian without prior regular military service.

Conversely, the bill allows appointment of a regular military man as deputy if the chosen administrator is a civilian without prior regular military service.

Assurance of adequate military representation in the new agency is provided by authorizing the direct assignment of armed services personnel to the FAA subject to the sole authority of the administrator. Other amendments to the Federal Aviation Act provide for:

• **Eight super-grade positions for** the Civil Aeronautics Board were approved after the House deleted a provision for 15. The positions are not to exceed grades 16, 17 and 18.

• **Fifty supergrade positions were** restored to the FAA after a House deletion of a provision for 100. The positions are in addition to those presently authorized for the CAB, CAA and AMB. Some super-grade positions of CAB would be transferred to the Federal Aviation Agency.

• **Use of consultants was limited** to 100 days in any calendar year.

CAA Reports Plans For Control Facilities

Washington–Civil Aeronautics Administration last week announced procedures for the implementation of its Fiscal 1959 air traffic control and navigation facilities program at a cost of $175 million.

Largest program of its kind in the agency's history, it provides for installation of long-range radar units for five CAA air route traffic control centers and the use of radar information from 11 existing or planned military units from which information will be microwaved into CAA control centers.

A total of 19 airport surveillance radars (ASR) will be installed at CAA traffic towers, 10 of which also will be equipped with airport surface detection equipment (ASDE). Also included are 42 radar beacons for radar units and six for use with surveillance radar.

The program further provides $3,235,000 for an air traffic control operational analysis for the CAA Technical Development Center at Indianapolis, $820,000 for a runway extension at Wake Island and $1.2 million to rehabilitate the airport at Nome, Alaska.

In addition the program calls for:

• **Installation of instrument landing** systems (ILS) at 19 new locations, including a second ILS at four locations.

• **Control towers** for 23 airports.

• **Relocation of 10 air route traffic** control centers.

• **Installation of 62 Vortac systems** and the integration of 150 existing VOR units with Tacan to make up Vortac stations.

Los Angeles Renewal Recommended for SAS

Washington–Scandinavain Airlines System last week was recommended for a renewal of its Stockholm-Los Angeles authority and a new foreign air carrier permit for a route to include Sweden, Denmark and Norway with the terminal point in Anchorage, Alaska.

In making the recommendation, Civil Aeronautics Board Examiner Leslie G. Donahue criticized as "contrary to the intent of bilateral agreements" a request by Trans World Airlines that SAS be required to submit to CAB origination and destination studies of its traffic from the U. S. for March and September of each year as required for U. S. flag carriers.

Britannia Completes Half-Year in Service

By Glenn Garrison

New York—First turbine-powered airliner to ply the North Atlantic performed satisfactorily during its first six months of service, according to British Overseas Airways Corp. and El Al Israel Airlines.

Long-range Bristol Britannia turboprop was put into transatlantic service last December by both carriers.

Their evaluation of its operation during the first half-year includes these points:

• **No icing problems** have been encountered on the route. Proteus 755 and 761 engines which power BOAC's Britannia 312s and El Al's Britannia 313s include modifications designed to prevent the engine icing which plagued BOAC's Eastern operations with the shorter-range Britannia 102.

• **Few maintenance problems** have developed with airframe and engines, but a number of bugs have shown up in components, particularly electrical units. Modifications have been made and others are in process.

• **Cruise control techniques** are still being refined. BOAC as yet has no hard and fast rules for cruising the Britannia, but is inclining toward high speed cruise procedure rather than maximum range procedure. El Al has standardized its basic techniques, expects only minor improvement to be evolved.

• **Flight times** have averaged out about as scheduled for BOAC, and no changes have been made in schedules. El Al has been somewhat disappointed with eastbound times and has increased eastbound scheduled time slightly. BOAC made 46 unscheduled stops out of 209 crossings during the period Dec. 8 through July 12. El Al one-stopped nine times out of 164 crossings in six months.

• **Economy of operation** is attributed to the aircraft by both carriers. El Al, which took a giant stride from Lockheed 049 Constellation equipment to the big turboprop, says the cost of a ton-mile to the airline has been cut about 20%.

Indications are that the government controlled carrier will make a profit this year for the first time in its history.

Neither carrier found it necessary to provide any special maintenance facilities for the aircraft as such. BOAC's overseas arrangements for spares have followed the normal pattern used for other aircraft. Training also was standard for BOAC.

El Al Strategy

El Al, as a small airline, had a king-sized problem in introducing a larger, more complex aircraft of a new type into its transatlantic operation. Training and spares procurement started a year before delivery of the Britannia. To keep the number of spare engines needed as low as possible, El Al arranged an engine exchange plan with Bristol Aeroplane Co. Under the plan, run out or prematurely removed engines are sent to London and exchanged for zero time engines. At the time El Al bought its Britannias, overhaul period for the Proteus engines was 450 hr.

It is now at 850 hr. and El Al expects to reach 1,050 hr. by the end of this year.

El Al set up a special technical planning and operational development department to handle the problem of integrating the Britannia. After commercial service began, the members of this department were absorbed back into their usual administrative functions.

The airline also enlarged its training school and sent instructors and other key personnel to Bristol and to component manufacturers for training before the aircraft were delivered. New hangar, workshops and the like were built to handle the plane. Detailed maintenance schedule worked out in advance consists now of numbered checks. The airline plans to change over to an equalized maintenance program soon, however, because it has found that the complexity and size of the aircraft causes unacceptably high times to accomplish numbered checks.

El Al has found the Britannia's engines virtually trouble free, it reports, but would like to see considerable improvement in aircraft component reliability. Electrical systems have caused the most trouble. Other original difficulties were freezing toilet drains and precipitation of condensed humidity through the cabin ceiling. These faults have been corrected. All in all, however, El Al feels that the number of bugs encountered in the Britannia components is reasonable for a new aircraft.

El Al scheduled faster transatlantic flight times with its Britannias than did BOAC—8 hr. 30 min., eastbound, 10 hr. 50 min. westbound, compared with BOAC's 10 hr. 4 min. and 11 hr. 58 min. The Israeli carrier averaged 10 hr. 39 min. actual time westbound during the first six months, less than the scheduled time. Eastbound, however, the New York-London actual time averaged 9 hr. 9 min. more than scheduled. So El Al's eastbound scheduled time has been changed to 8 hr. 50 min. Disappointing eastbound results are attributed to less westerly wind component than expected, and to air traffic control difficulties.

The eastbound traffic control penalties are much greater than expected, El Al says. The Britannia in high speed cruise prefers the same eastbound altitudes used by piston airplanes, but the turboprop is faster, and controllers want to hold the Britannia more than an hour from the time a piston plane occupies the desired altitude.

Eastbound flights without traffic-imposed time penalty are rare, El Al reports.

Many of the nine non-scheduled stops (all of them were on London-New York flights) were necessary because of terminal weather, according to the airline.

BOAC's actual nonstop times have averaged out to 10 hr. 4 min. eastbound—hitting the scheduled time on

National Builds Jet Hangar in Miami

National Airlines hangar at Miami International Airport is designed to provide sufficient stanchion-free workspace to accommodate six Douglas DC-8s. Each cantilever projects 112 ft. from 48-ft. wide center core. Weed Johnson Associates, Miami architectural company, designed the hangar which is 450 ft. long.

the nose—and 11 hr. 40 min. westbound, 18 min. better than scheduled. The 46 unscheduled stops brought times for those flights to averages of 15 hr. 36 min. westbound and 12 hr. 4 min. eastbound.

The British carrier uses both high speed cruise and maximum range cruise, but lately has been finding the high speed procedure more suitable to its operation. This operation is carried out at just below V_{MO} (maximum normal operating speed) at maximum engine cruise rating. As weight decreases and indicated air speed reaches V_{MO} altitude is increased usually in 2,000-ft. steps, reducing IAS by approximately 8 to 10 kt.

Fuel consumption in the BOAC Britannias has averaged out at 630 imperial gallons an hour on an over-all block-to-block basis. El Al's technique involves controlling cruise for variable fuel reserve. Reserve is adjusted as a flight progresses by going into longer or shorter range cruise, keeping fuel reserve at the exact amount needed under actual conditions encountered. El Al also points out that very precise techniques of handling and cruise control are needed to avoid mushing in maximum range step climb. Power available for climb is the same as that used for long range cruise, so no reserve power is available for step climb.

BOAC began New York-London service modestly with once-weekly "fact-finding" flights, stepped up into two weekly round trips. Meantime, services through Montreal to Detroit and Chicago were started in April. The aircraft also serves San Francisco through New York.

BOAC mixes its seating configurations a variety of ways in its Britannias, while El Al carries 72 economy seats and 18 first class and deluxe. Both airlines say the airplane is popular with the passengers.

Sample passenger load factors on BOAC's Britannias show a 66% average on 43 mixed class round trips between London and Chicago; 61% on 12¼ mixed London-San Francisco round trips; 54% on 4½ first class round trips between New York and London.

El Al carried 8,882 transatlantic passengers during the first half of 1958, up from 3,453 for the first six months of last year. During the last month under consideration—June, 1958—the carrier's transatlantic passenger load factor was 87.7%.

The airline says its Britannia service has greatly widened its range of customers. Promoting the airplane has identified El Al beyond the passengers concerned primarily with travel to Israel.

Not only did El Al go into service with a drastically different airplane from its 049 Constellations, it also offered first class service for the first time. To promote all this in the U. S., the small airline decided to spend $250,000 here in advertising and came out with a full-page newspaper ad that excited a good deal of comment. The ad was principally a photograph of the ocean, with the announcement that the Atlantic would soon be 20% smaller—via the high-speed Britannia, of course. Among other devices was the use of a new aluminum paper stock for promotional material "to reflect the gleaming skin of the Britannia." On the other side of the Atlantic, El Al expanded its sales force and waged promotional campaigns at its main traffic generating points, Israel, London, Paris, and some other European stations.

Delays Hurt BOAC

BOAC might have reason to be a little touchy about its own promotion of the Britannia. Some of the steam was lost because of delivery delays that put BOAC's Britannias in service later than advertised.

Evaluation by its two transatlantic operators would indicate that the long-range Britannia is proving itself a successful airplane on the highly competitive route. But a question remains: did the Britannia bow too late on the Atlantic, only to be obscured by the big pure jets which will be flying the route this year?

BOAC officials feel that the turboprop can hold its own for the first few years of the pure jet age (AW Jan 27, p. 43). And El Al Managing Director Brig. Gen. E. Ben-Arzi believes the Britannia will give his airline a breathing space in which to study the jet field before deciding on future equipment.

If International Air Transport Assn. doesn't adopt a fare differential plan for the Atlantic thus giving non-jet aircraft a new economic lease on life, El Al will again be faced with a compete or retreat decision in its transatlantic operation, according to Ben-Arzi. The airline's studies indicate that El Al would need a minimum of three long-range jets for a sound operation economically. How much it would cost to acquire and operate such a fleet, and whether sufficient income from the aircraft can be assured, are the two questions El Al must answer before it can decide whether to compete on the Atlantic when the jets are out in force.

But the imminent appearance of jets does not present an immediate threat to El Al's Britannias, the director said. Time advantage of first operations will be curtailed by the need for fuel stops, and Ben-Arzi doesn't expect nonstop transatlantic jets to be available in great numbers before 1962.

El Al last month received a fourth Britannia from Bristol on a rental basis. It will be replaced by a Britannia now on order for February delivery.

Comet Takes Idlewild Noise Test As Step to Transatlantic Service

New York—Britain's Comet IV performed last week at New York International Airport for noise experts who, the British hope, will clear the four-jet de Havilland transport for scheduled transatlantic service into Idlewild this fall.

Unofficial target date for British Overseas Airways Corp. initial Comet service has been Dec. 1, but the company hopes to better this and to beat Pan American's Boeing 707-120 onto the run. The 707 is due at Idlewild later this month for restricted trial operation to Puerto Rico (AW July 21, p. 30).

Pan American would like to begin service Nov. 1. To win the jet "first" on the Atlantic, BOAC will have to get the Comet into service in October or count on a delay in the American carrier's schedule. With the uncertainties yet remaining, the contest would seem to be still open at this point.

Comet's Maiden Crossing

Comet IV made its maiden Atlantic crossing Aug. 10 in a flight time of 8 hr. 53 min. to New York. Chief test pilot John Cunningham of de Havilland took off from Hatfield at a maximum gross weight of 158,000 lb.

Operation was in level cruise at about Mach .73 to Gander at altitudes of 35,000 and 39,000 ft. After 1 hr. 40 min. on the ground at Gander, the Comet proceeded to New York at 35,000 ft. Headwinds averaged about 70 mph.

Fuel Consumption

On the westbound crossing, the Comet burned about 7,920 lb. of JP-1 fuel an hour. Drift climb technique would have cut fuel consumption by about 440 lb. per hour, but traffic control precludes use of this procedure.

The Port of New York Authority stationed its sound consultants at points adjacent to and near the airport in the Borough of Queens for the Comet's takeoff tests. Noise was measured at locations 2½ mi. and 3½ mi. from point of takeoff. Sound equipment was respotted for landing tests to locations 1 mi. and 2 mi. from normal touchdown point. Simulated takeoffs and landings and flybys at various altitudes and power

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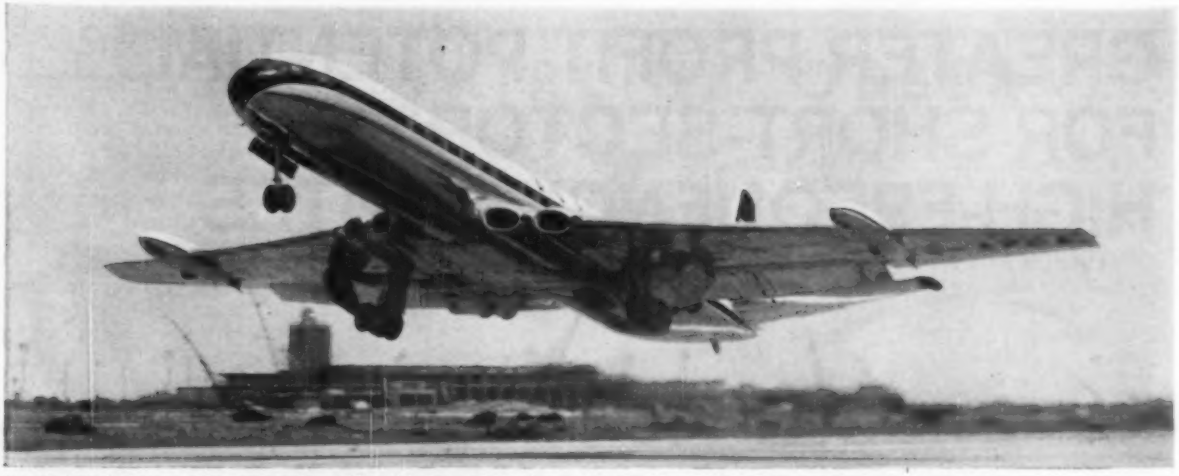

COMET IV jet transport takes off from Idlewild, New York, for noise test after making its first transatlantic crossing.

settings also were performed, the entire program consuming about 3½ hr.

The Comet, in BOAC colors and first-class configuration, was ballasted for the tests to bring its gross weight up to the 158,000 lb. maximum and to simulate an actual schedule with 76 tourist passengers and a full load of fuel. It carried 72,000 lb. of fuel at initial takeoff, dumped 17,000 lb. over water in two operations and had 19,000 lb. of fuel remaining at the final landing.

Maneuvering was done at altitudes up to 10,000 ft. and the plane reportedly handled easily in the traffic pattern, accomplishing regular circuit turns at 148 kt. airspeed. At maximum weight, the Comet used 5,200 ft. of the 9,500 ft. runway for its takeoff.

Cameras aboard the Comet recorded instrument readings at the various check points and conditions, and this data will be forwarded to Bolt, Beranek and Newman, Inc., the Port Authority's noise consultants. The test program was completed, but results will not be available for several weeks. The Comet returned to Hatfield in 6 hr. 26 min. nonstop, fastest crossing by a civil aircraft.

Plane was fitted with 57 seats. Normal standard first class configuration includes 60 two-abreast seats in a forward and an aft compartment, but three seats were removed to make room for flight recording instruments. Galley and two lavatories are located forward, with two more lavatories aft. A nonpressurized cargo compartment is located behind a coat room at the rear of the cabin. Baggage compartments are under the cabin floor. Other standard configurations are 76 tourist and a mixed arrangement of 43 tourist and 24 first class.

BOAC plans to operate the Comet nonstop eastbound and one-stop westbound on the North Atlantic. Same scheduling probably will apply to Pan American's 707-120. Pan American will get longer-range Boeings late next year, and BOAC will begin receiving its Boeings in 1960.

Tests of the Comet IV for Air Registration Board certification are about 95% complete, according to Peter Bugge, de Havilland chief development pilot, who flew as second pilot on the transatlantic trip. Remaining tests include 100 hr. of flying BOAC air routes, including the Far Eastern segments.

First deliveries to BOAC originally were planned for Sept. 30, but now are expected earlier next month. One advantage BOAC has in the jet race is crew training accomplished with the Comet 2E over a period of time. This includes a recent series of trial schedules on the Atlantic route, with simulated landings at Idlewild and actual landings at other North American terminals.

First delivery to BOAC actually will be the third production Comet IV. The de Havilland aircraft here last week was No. 1, and No. 2 is in the pressure tank.

Among the 22 persons making last week's transatlantic Comet trip was Ferd Greatrex, director of Rolls-Royce's flight development establishment, under whom suppressors for the Comet IV's Avon RA29 engines were developed.

PanAm Plans Paris Airport Shift To Avoid Delaying Jetliner Service

Paris—Pan American World Airways will have to temporarily shift its Paris terminal operation from Orly Airport to Le Bourget as a result of a Paris Airport Authority Ruling that jet aircraft cannot land at Orly until runway extension work is completed.

Extension work on the Orly east-west runway won't be completed until next summer. Pan American expects to start North Atlantic jet service this fall. TWA, while its jet plans are still unknown, probably won't be affected by the ruling since its North Atlantic jet service will likely start after the Orly runways are ready.

Rather than have two terminal services at Paris, one for its jet service and another for its piston aircraft, Pan American already is planning to shift over to Le Bourget. Once Orly is ready, then Pan American will shift back.

The Orly jet ruling was made known recently when Paris Airport Authority approved landings only at Le Bourget by new jet service operated by Aeroflot (AW Aug. 11, p. 33) and Czechoslovakian Airlines C.S.A. Both lines are using Tu-104s. Aeroflot on Aug. 4 made its first commercial flight into Paris, flying from Moscow in 3 hr. 5 min. with 16 passengers and 450 lb. of cargo.

Both Aeroflot and C.S.A. are required to follow a new procedure established by the Airport Authority which includes the requirement that only daytime takeoffs and landings will be permitted and rapid climbout to 1600 ft. must be expected immediately after takeoff. The Paris Airport Authority noted that the same regulations will apply to Pan American Boeing 707 aircraft when operating at Le Bourget.

Reason for the Orly ban is that the only runway presently available for jet operations is north-south. But using this runway, Airport Authority says, would require low altitude flights over populated regions. East-west runway, being lengthened to 10,800 ft., won't involve flights over large populations.

SHORTLINES

► **Allegheny Airlines** reports a new company traffic record during July with a total of 8,073,344 revenue passenger miles. The airline also has had a steady growth in air freight traffic which is up 20% over last year.

► **Canadian Air Transport Board** has established a new regulation requiring all non-scheduled non-Canadian air carriers licensed by the Board to fly into Canada to file annual reports in Ottawa by March 1 of each year. The reports must summarize flights and traffic carried into and out of Canada on such flights but does not specify how detailed the calendar year reports must be.

► **Irish Air Lines** has opened a new office in Boston to handle passengers and traffic passing in and out of that city when the Irish carrier begins scheduled service to Shannon and Dublin on Oct. 9. The offices have facilities for sales, reservations and ticketing operations.

► **LAV, the Venezuelan airline,** carried 20,749 passengers on its routes between the U.S. and Venezuela during the first three months of 1958, a 15% increase over the same period of last year. LAV flew 9,048 passengers southbound and 11,701 northbound during the period as compared with a total of 17,980 passengers in the first quarter 1957.

► **Lufthansa West German Airline** has announced that Rhein-Main Airport at Frankfurt has been designated as the Federal Republic's first commercial jet airport. The field's main runway has been lengthened to 1.87 mi. and preparations are underway to enlarge ramp facilities and new departure waiting rooms and arrival installations. Frankfurt was to become Europe's fourth free port of entry on Aug. 15.

► **Mohawk Airlines** effective Aug. 13 does not require passengers traveling solely over Mohawk routes to reconfirm their reservations or acquire their tickets in advance. Aimed at reducing passenger inconvenience, the new policy is a result of recent Civil Aeronautics Board approval exempting Mohawk from the three-part No-Show Control Plan which Mohawk had voted against.

► **Compania Cubana de Aviacion** is increasing its Bristol Britannia order from two to four. First Cuban Britannias are scheduled for delivery late this year, with the second two scheduled to arrive in the spring of 1959. Bristol and Cubana have agreed to form a joint engine overhaul base at Havana. Total orders for the turboprop transport now stand at 76.

AIRLINE OBSERVER

► **American Airlines is now thinking in terms of January for first jet services instead of late this year as previously announced. Later inaugural plan is not the result of unforseen delays, but of "a more realistic appraisal of the requirements of training and other pre-service activities."**

► American Airlines will use the speed advantage of its Convair 600 jet transports (AW Aug. 4, p. 38) to try to capture a competitive lead in the New York-Los Angeles market. Carrier will inaugurate a "Blue Streak" nonstop service with the turbofan airliner, which reportedly may have a 45 minute transcontinental advantage over jet transports. American recently ordered 25 of the area rule design Convairs for delivery in 1961-62.

► **Flight Safety Foundation reports evidence of heavy mental and physical strain on Civil Aeronautics Administration radar operators working in traffic control. In on-the-spot studies to establish criteria for traffic controllers, the foundation found that, during an eight-hour period, the average radar operator slumps from a position approximately 20 inches from the screen to one only a few inches away as result of fatigue. In studies at Chicago, Pittsburgh and Washington, operators were given physical examinations upon reporting and leaving duty shifts. During working hours, blood pressure readings were taken every 20 minutes in addition to finger temperatures and rate of eye blinking, and photographs were made every 15 seconds to study dilation of the pupil of the eye.**

► Aeroflot, Russia's state-owned airline, is showing significant traffic gains, according to Chief Air Marshal Zhigarev. Marshal Zhigarev reported in Izvestia that the Soviet airline flew 67.9% more passengers and 28.3% more ton miles during the first half of 1958 than during the same period of 1957. Zhigarev also contends that the Tu-104 jet transport is no more noisy than any other foreign plane, adding that the Soviet Union is willing to place the aircraft on a regular Moscow-London flight on any day acceptable to the British. British authorities, however, say that it is questionable if the two governments will agree to the new service unless the Soviets carry through their promise to equip the jet airliner with acceptable noise suppressors.

► **Capital Airlines has formed a special Cost Reduction Task Force in an effort to reduce heavy overhead costs on a system-wide basis. Meeting twice a week, the group is currently examining efficiency of the airline's general office departments in Washington before beginning a field investigation of station costs.**

► KLM Royal Dutch Airlines is installing closed circuit television cameras in its new turboprop test bench at Schipol Airport, Amsterdam. Television is expected to solve problems encountered with limited view observation windows used during eight-hour engine test periods. Bench will be used for routine checks on KLM's Rolls-Royce Dart engines used in the Vickers Viscounts and the Allison engines which power the 12 Lockheed Electras on order by the airline.

► **Russia is shipping record quantities of airfreight to its scientific stations on drifting ice packs near the North Pole. Airlift requirements of the Arctic points, according to a report in Izvestia, have become so great the USSR plans to put new Il-18 Moskva and An-10 Ukraina four-turboprop transports on this supply run before the end of the year. Soviet Polar Stations 6 and 7 recently received over 300 metric tons of airlifted cargo in less than a month.**

► Heavy backlog of congressional business has resulted in the granting of a one-year extension of present airline pass privileges. Civil Aeronautics Board last October told airlines to tighten their pass policies but suspended its order four months later in the face of heavy opposition from the carriers until Sept. 1. CAB hoped for congressional action during this session on amendments to the Civil Aeronautics Act to resolve the issue, but has now advanced the suspension order to Sept. 1, 1959.

Airline Traffic—June, 1958

GREATER PROFIT POTENTIAL FOR SHORT-SECTOR, HIGH-FREQUENCY ROUTES

Low operating costs... best of any postwar aircraft in this category... designed for low break-even load factors on local service operations.

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Dependable, economical Rolls-Royce power... four Rolls-Royce Dart 506 jet-props... unsurpassed for economy, ease of maintenance, length of overhaul cycle (TCA reports 1900 hours, test engines to 2000)... 300 mph at 10,000'.

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Airline Traffic—June, 1958

(IN DOLLARS)

	Revenue Passengers	Revenue Passenger Miles (000)	Load Factor %	U. S. Mail	Express	Freight	Total Revenue Ton-Miles	% Revenue to Available Ton-Miles
DOMESTIC TRUNK								
American	666,619	477,444	71.0	1,603,508	701,205	7,648,638	55,813,728	59.5
Braniff	172,199	76,002	59.8	284,670	142,195	557,696	8,284,481	49.3
Capital	348,956	140,422	58.1	538,647	274,177	357,526	14,613,980	47.2
Continental	74,363	37,579	47.8	97,053	43,633	162,406	3,912,375	40.5
Delta	226,955	113,191	58.4	374,869	250,162	971,055	12,483,610	53.4
Eastern	649,377	347,853	53.39	839,990	415,456	1,104,923	35,883,405	48.32
National	110,602	65,511	52.0	241,530	41,239	465,513	7,084,186	44.2
Northeast	83,698	30,272	44.1	57,341	25,531	83,341	3,067,082	36.3
Northwest	148,216	115,381	60.4	445,755	207,297	765,170	12,517,996	51.7
Trans World	423,345	370,073	69.9	1,151,311	562,500	2,027,957	39,195,038	61.4
United	622,736	483,535	68.9	2,298,789	781,381	4,930,397	54,413,562	59.7
Western	56,199	30,976	52.6	104,228	35,023	3,211,802	3,211,802	42.3
INTERNATIONAL								
American	9,882	8,584	45.3	7,729	505	292,857	1,199,502	50.4
Braniff	4,204	8,011	54.2	6,938	.....	83,134	964,965	47.0
Caribbean-Atlantic	18,525	1,312	56.97	1,572	.....	2,707	137,290	60.22
Delta	4,371	6,173	56.6	7,166	.....	29,492	724,508	48.7
Eastern	37,780	51,242	54.75	94,617	.....	110,476	5,465,838	53.50
Mackey	7,401	1,406	35.4	.....	.....	1,458	153,435	35.6
National	6,567	4,822	54.4	9,138	5,559	43,603	576,782	49.0
Northwest	15,105	34,571	63.2	1,003,006	13,144	675,118	5,338,557	67.7
Pan American	.....	.....	....	.....	.....	.....	.....	....
Alaska	5,561	6,463	71.6	27,914	.....	144,648	829,270	58.5
Atlantic	120,443	179,983	63.5	1,091,775	.....	2,079,203	21,917,542	60.4
Latin America	97,641	113,175	66.4	349,511	.....	4,099,648	15,098,350	64.2
Pacific	23,683	88,684	77.2	971,112	.....	1,400,180	11,638,081	74.0
Panagra	9,882	11,908	48.6	65,133	.....	371,350	1,752,268	51.7
Resort	.....	.....	....	.....	.....	3,906,540	3,906,540	76.3
Trans-Caribbean*	.....	.....	....	.....	.....	.....	.....	....
Trans World	35,166	100,520	55.5	900,835	.....	600,847	11,951,894	54.4
UMCA†	218	72	52.6	.....	.....	874	8,304	55.0
United	11,629	29,068	71.0	138,296	.....	86,948	3,192,309	67.8
Western	702	1,091	29.2	447	.....	2,074	121,561	27.2
LOCAL SERVICE								
Allegheny	44,830	7,863	49.3	9,923	17,498	20,519	798,647	48.9
Bonanza	14,761	3,441	44.8	4,299	2,290	8,301	343,581	42.9
Central	11,754	2,246	34.5	5,181	2,164	7,281	229,883	30.7
Frontier	20,804	5,538	50.4	17,970	8,741	50,240	609,615	58.2
Lake Central	14,714	2,347	37.8	3,428	12,856	.....	240,760	40.3
Mohawk	39,836	7,582	51.8	6,694	13,369	13,784	759,052	51.8
North Central	67,965	11,873	48.5	22,797	31,591	.....	1,198,583	48.9
Ozark	36,299	6,114	46.3	9,825	15,584	12,067	621,135	47.7
Pacific	32,947	7,352	53.9	10,512	4,856	6,751	723,103	51.6
Piedmont	37,408	7,863	55.7	14,910	10,741	13,488	793,434	55.1
Southern	18,309	3,341	38.6	7,479	8,797	5,308	341,885	38.2
Trans-Texas	19,482	4,351	37.8	13,824	7,180	25,167	463,582	38.5
West Coast	22,212	4,066	49.72	4,871	2,694	8,844	404,552	47.41
HAWAIIAN								
Hawaiian	39,625	6,061	61.9	4,125	.....	136,680	628,821	57.4
Trans-Pacific	18,308	2,442	64.0	679	.....	6,871	203,686	63.7
CARGO LINES								
AAXICO*	.....	.....	....	.....	.....	.....	.....	....
Aerovias Sud Americana	.....	.....	....	.....	.....	636,229	636,229	86.5
Flying Tiger	9,411	42,198	100.0	31,168	23,718	7,696,784	11,971,502	90.4
Riddle	.....	.....	....	21,971	16,214	1,591,056	1,629,241	77.2
Seaboard & Western	6,028	23,975	100.0	74,253	.....	930,975	3,424,401	67.5
Slick	2,276	15,630	98.75	.....	.....	200,055	1,763,084	98.88
HELICOPTER LINES								
Chicago Helicopter	9,101	164	36.6	1,367	.....	.....	17,028	28.2
Los Angeles Airways	3,335	124	58.2	4,306	1,876	.....	17,984	62.7
New York Airways	8,763	159	47.0	1,244	733	475	17,645	47.1
ALASKA LINES								
Alaska Airlines	6,237	3,421	39.1	50,241	.....	303,924	35,575	44.4
Alaska Coastal	6,383	539	60.5	3,484	.....	5,165	63,716	61.2
Cordova	1,040	169	44.1	3,814	.....	16,504	35,574	44.2
Ellis	5,695	321	55.7	1,883	.....	3,005	37,701	65.4
Northern Consolidated	2,428	744	49.9	22,461	.....	70,452	174,322	61.9
Pacific Northern	12,528	12,155	61.6	91,266	5,330	262,316	1,672,480	66.8
Reeve Aleutian*	.....	.....	....	.....	.....	.....	.....	....
Wien Alaska	2,983	1,154	25.4	34,256	.....	131,820	284,940	50.3

* Not available. † Urabe, Medellin & Central Airways.

Compiled by AVIATION WEEK from airline reports to the Civil Aeronautics Board.

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Power growth of the Dart prop-jet

Dart prop-jets of 2,100 t.e.h.p. now being delivered, compared with the first production engines supplied in 1952, give—

36% more power for take-off
12% lower specific fuel consumption
12% higher power/weight ratio

During the five years since it entered airline service the overhaul life of the Dart has been raised as far as 1,900 hours.

Dart engines of 2,660 t.e.h.p. for delivery in 1960 will show the following improvements over the first production engines—

73% more power for take-off
15% lower specific fuel consumption
36% higher power/weight ratio

Work is in progress on versions of the Dart at higher powers and lower fuel consumptions, and a 25-hour test has already been successfully completed at a rating of 3,200 s.h.p. for take-off.

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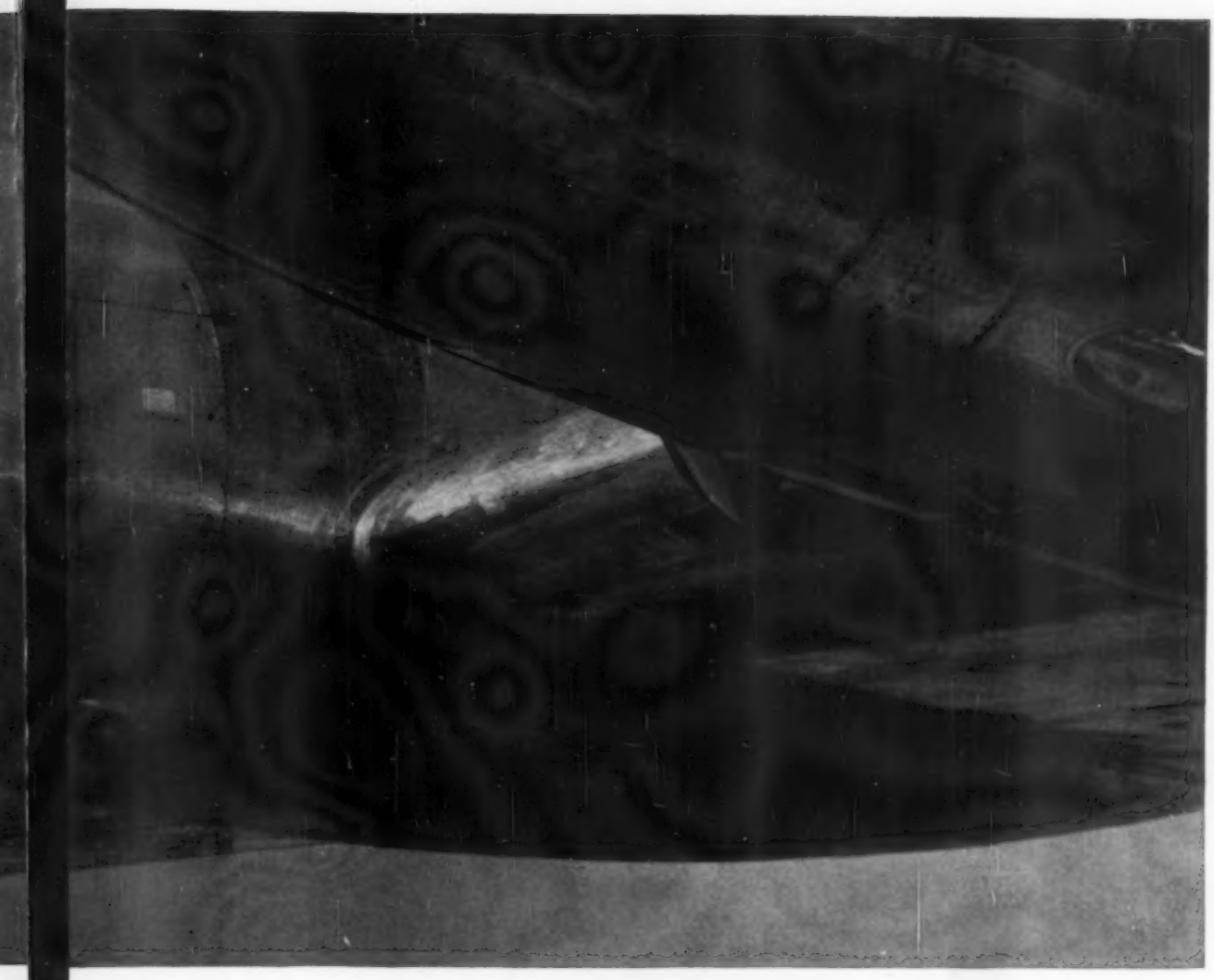

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First axial engine on the world's international routes, the Proteus is also the first engine to feature the free-turbine system, pioneered by Bristol. This system gives flexibility in choice of power and propeller speed, produces remarkable efficiency over a wide range, and results in *very* low noise and vibration levels.

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SPECIAL BULLETIN...NEW BRISTOL PROTEUS RECORD... NOW APPROVED 1600-HOUR OVERHAUL LIFE AFTER ONLY 18-MONTH AIRLINE SERVICE

Soviets Report to IGY on Satellite Dog

Moscow—Details of biological experiments with Laika, the dog which lived for seven days aboard orbiting Sputnik II, were revealed by Russian scientists recently at an International Geophysical Year congress here.

Report on Laika indicated weightlessness may be less of a problem in space travel than was previously anticipated. One top Soviet scientist said he believed man could survive without ill effect any weightlessness encountered during a period of travel, at least to the moon.

The Laika paper was one of a number of reports on rocket and satellite programs exchanged by Soviet and American scientists at the congress, held to evaluate the first year of the 18-month IGY program. Privately, some American scientists complained that the Russians were withholding basic data on Soviet satellites which Americans already have published on the U. S. Explorer and Vanguard projects.

Russians Withhold Data

Specifically mentioned was the lack of information on Russian orbital elements—a piece of information which would lead to computation of launching sites, which never have been announced by the Russians.

Americans attending the sessions said, however, that their Soviet colleagues were both cooperative and friendly in the exchange of most data. In addition to rockets and satellites, symposia and working meetings were held on such subjects as oceanography, cosmic radiation, nuclear radiation, geomagnetism and seismology.

Other data released on Soviet satellite programs included papers on solar batteries and cosmic radiation. American Robert Jastrow of the Naval Research Laboratory delivered a paper on the tracking of Sputnik I during its final days which showed the rocket casing landed in outer Mongolia. This was the casing which Premier Nikita Khrushchev, with the backing of the Soviet Academy, charged landed in Alaska.

Laika Observed

Paper delivered by Soviet space biologist Vladimir Yazdovsky said observations of Laika aboard Sputnik II enabled a study of steady and continued effects of acceleration, noise and vibration as well as a prolonged state of dynamic weightlessness during orbiting. Telemetric reports showed Laika was frightened during takeoff but Yazdovsky said the dog survived the entire experiment. After acceleration started, the rate of heartbeat increased by three times but this decreased as acceleration decreased.

Heartbeat as shown by electrocardiograms was as expected.

During weightlessness in orbit, movements of the animal became short and smooth, rate of breathing became slower and heart rate decreased to normal. However, the rate at which Laika's heartbeat decreased in a state of weightlessness was three times slower than had been assumed from laboratory tests. Yazdovsky suggested that was due to a weightless state as contrasted to normal weight in the laboratory.

Electrocardiograms showed some changes in heartbeat during initial stages of weightlessness but these were not pathological and soon disappeared. There were no essential changes in physiological function due to weightlessness, the Soviet space biologist said. Blood circulation was normal.

After seven days Laika was killed by poison in a final bite of food, Yazdovsky said. No attempt was made to assess the effect of cosmic radiation on Laika due to the impossibility of recovering the body, he added.

Yazdovsky said the Russians hope by accumulating more experimental biological data in further Sputniks to answer "in the very near future," many of the questions connected with the medical aspects of space flight.

The Soviets said during the congress that they are now at work on Sputnik IV which will be a "cosmic observatory." They did not elaborate but presumably this may be equipped with a telescope for viewing stars from above the earth's atmosphere with provision for a television relay earthward. Americans reported they are planning to launch a satellite with an instrument package developed by Signal Engineering Laboratories with two infrared photoelectric telescopes.

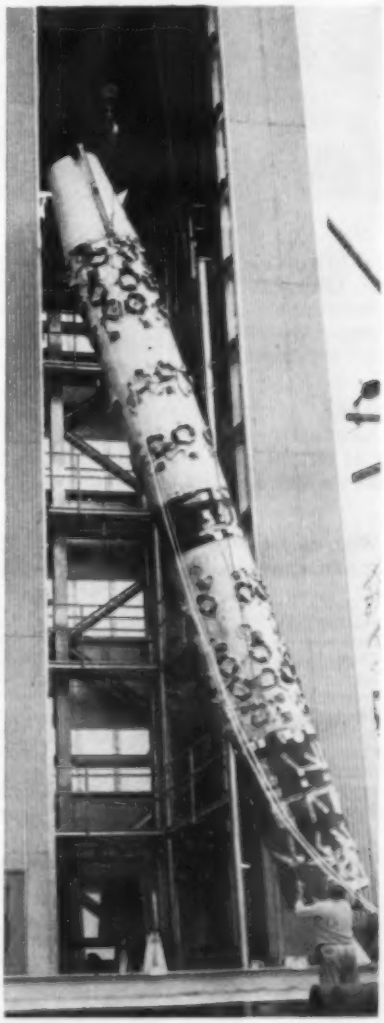
Enable Scanning

These will enable scanning of cloud masses, land and sea areas. Light intensity of scanned square sections would be recorded on the satellite's tape recorder and transmitted earthward to permit reconstruction of a mosaic picture.

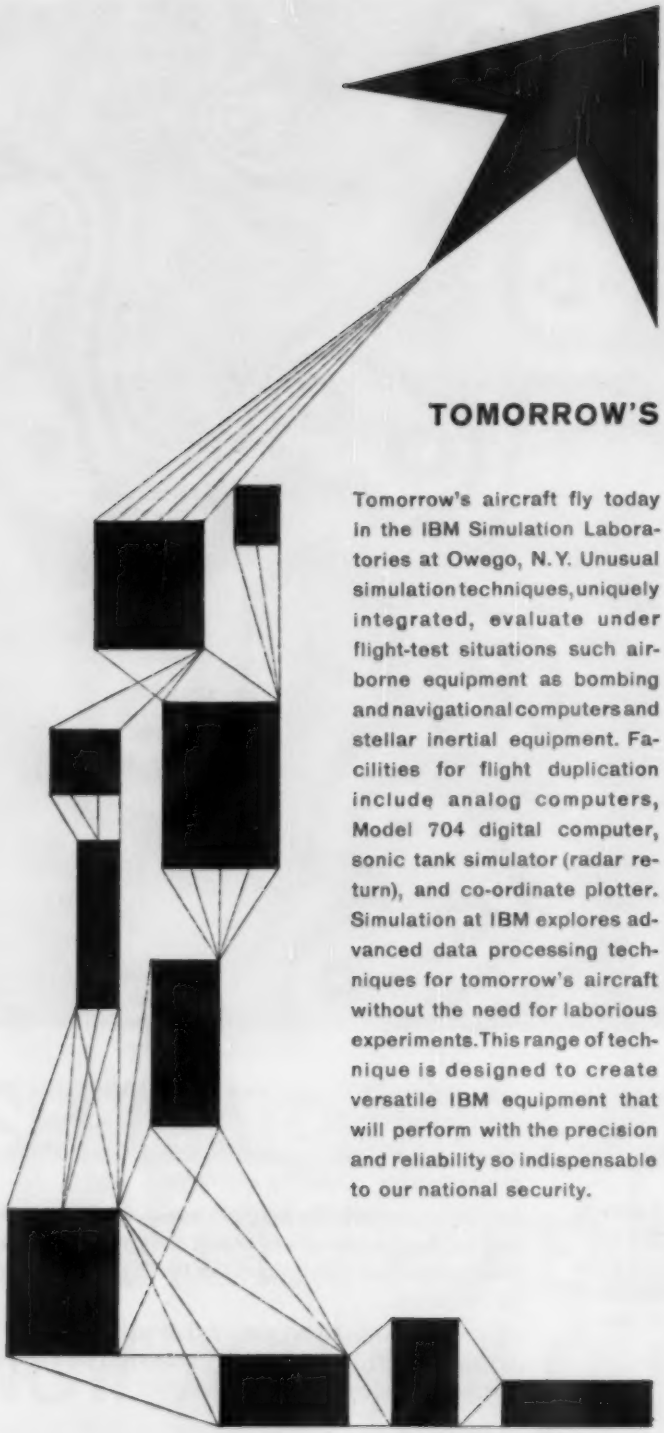
Rocket and satellite working subcommittee at the congress reached agreement on the need to avoid extraterrestrial contamination during exploration of space. Subcommittee also suggested that studies be undertaken of ways to set up traffic control of future satellite projects to avoid overcrowding of airspace around the earth. One problem discussed was the need to destroy unwanted satellites once their usefulness ended.

Presumably this would be done by a device to force them back into the earth's atmosphere where burnup would occur.

Description of the death of Sputnik II was compiled by Dr. Luigi Jacchia of the Smithsonian Astrophysical Labora-



FIRST stage of Vanguard satellite vehicle is placed in test tower at the Martin Co.'s Baltimore plant for ground resonance survey. Round wire coils are used to record information through strain gages and other devices. First stage is 44 ft. long.



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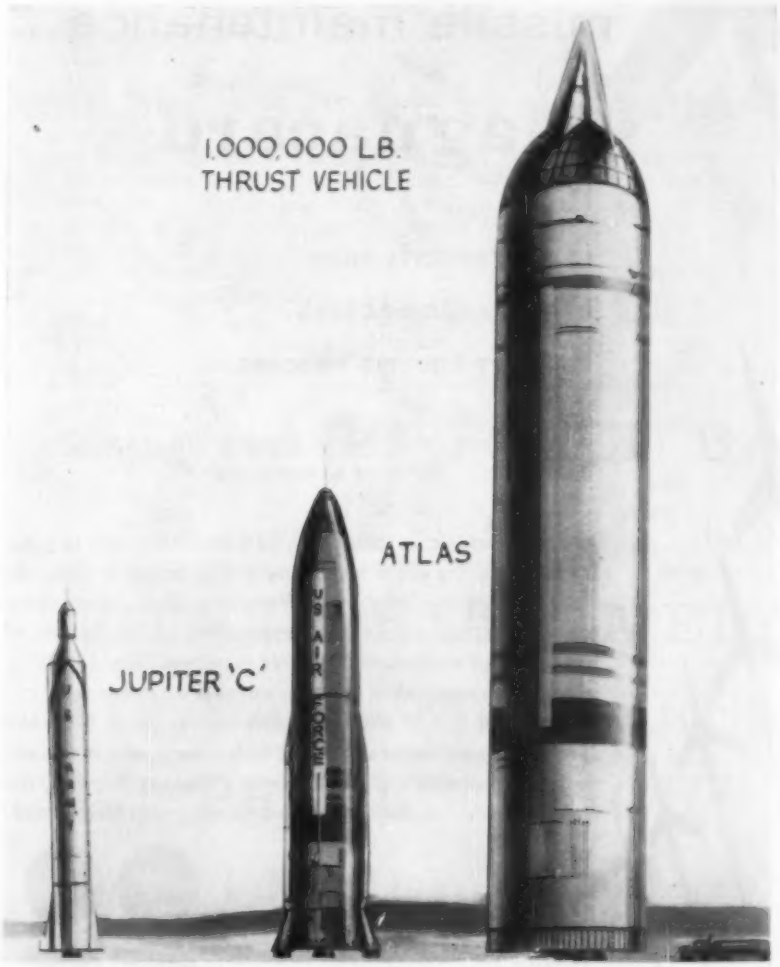
tory from eyewitness reports. He described it as a "spectacular sight" with the glowing Sputnik shedding molten metal and trailing a 60 mi. tail on its final plunge into the atmosphere off Barbados and British Guiana. No Russian data on this or the final days of Sputnik I have been given at the meeting. American scientists here attribute the lack of some Russian data to the fact that raw material has not yet been compiled and analyzed and also suggest the Russian tracking and reporting network may not be as efficient as the United States'. American scientists were shown some of the instrumentation aboard Sputnik III. This included an induction magnetometer used in transmitting data on magnetic fields.

Telemetered records obtained from this instrument also were shown but this data has not yet been interpreted.

Americans described the magnetometer as a "nicely built instrument." They said it was larger and heavier than U.S. instruments of similar quality with no apparent effort to miniaturize it.

Proposal for cooperation with the Russians and other nations on space flight projects was put forward at the IGY meeting. No action was taken on the proposal since a similar resolution was said to be before the International Council of Scientific Unions but it raised the intriguing possibility that the crew of the first lunar or space ship might be international in character if such agreement could be reached.



Million Pound Thrust Vehicle

Drawing by Rocketdyne Division of North American Aviation shows comparative size of vehicle that could be boosted with a million pound thrust rocket. Rocketdyne has received a contract from Wright Air Development Center to build major components for a million pound thrust liquid propellant engine. Under separate contract, USAF has requested Rocketdyne to develop an engine in the intermediate range between current propulsion systems and a million pound thrust rocket. Work on an intermediate rocket has been under way at Rocketdyne since mid-1955. Both projects will be developed at the main Rocketdyne plant at Canoga Park, Calif. Intermediate and million pound thrust engines are designated E-1 and F-1 respectively by Rocketdyne.

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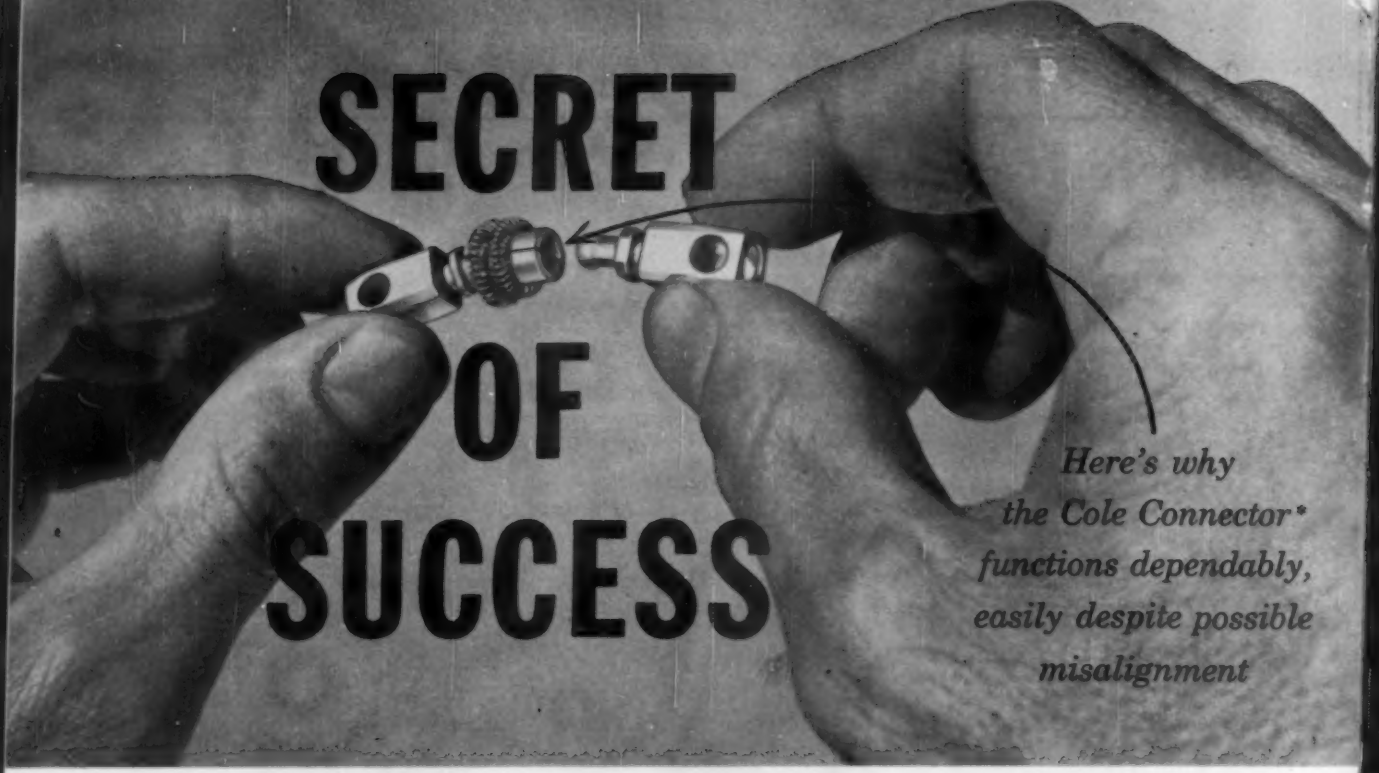

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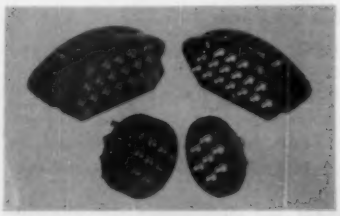

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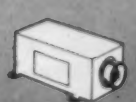

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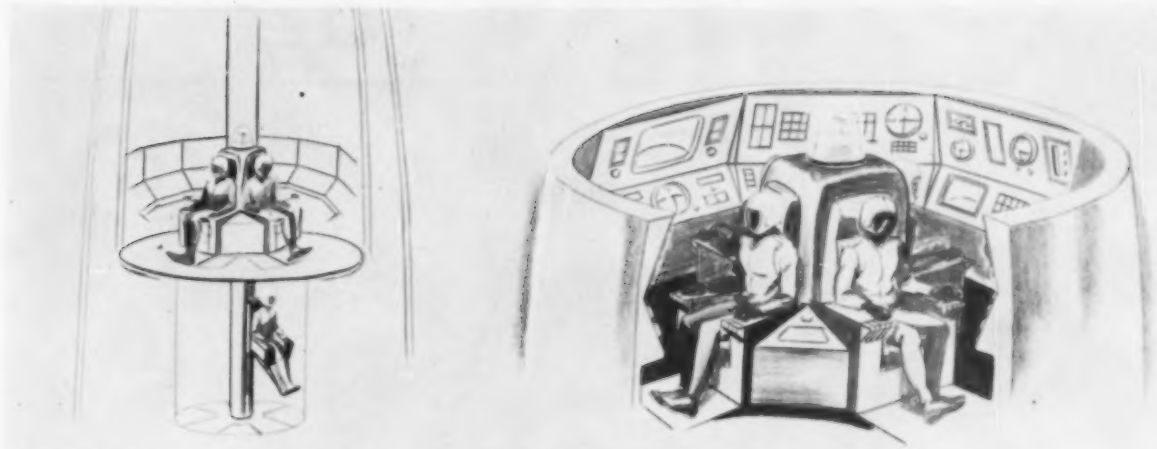

LEAR will construct model space vehicle capsule under WADC contract. Crew would enter control room (right) by elevator (left).

Lear Studies Space Crew Controls

Grand Rapids, Mich.—Lear, Inc., will study manned space vehicle flight crew requirements and construct a model crew capsule including instrumentation and related flight controls, under a contract recently awarded by Wright Air Development Center's Flight Control Laboratory.

New program is a space-oriented continuation of the integrated whole-panel flight instrument investigation for piloted aircraft which Lear recently completed for WADC's Flight Control Laboratory.

During the next 18 months, Lear engineers will visit all companies known to be working on space vehicle and space weapon programs to assist in determining what sort of instruments and controls space travelers will require to perform their mission. Scope will include instrumentation required for navigation, orientation, propulsion, power generation and providing of inhabitable environment within the vehicle. Engineering psychologist Dr. Malcom Ritchie and his associates will work with Lear engineers in determining crew requirements. Part of their task will be to determine which func-

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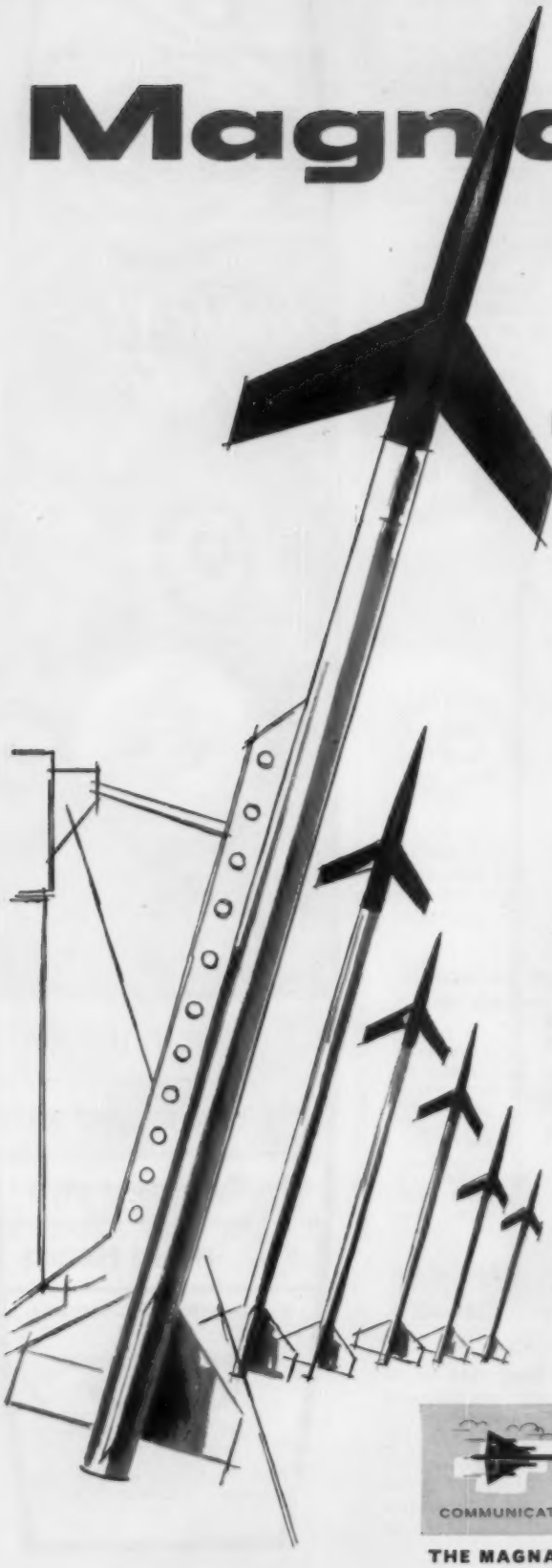

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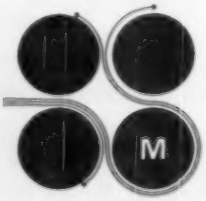

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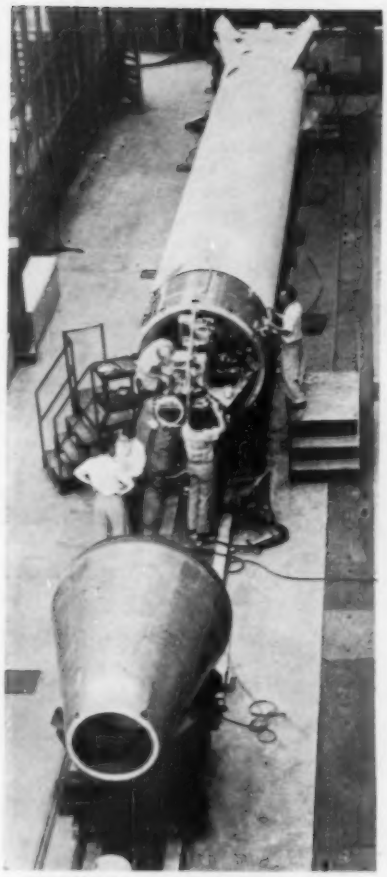

Guidance Tests

Guidance and control section of U.S. Army's Jupiter-C four-stage missile is tested in Systems Analysis and Reliability Laboratory at Army Ballistic Missile Agency, Huntsville, Ala.

tions should be performed automatically, which are best left to the crew.

Lear says that specific mission for the crew space capsule is not yet established. It may be for an orbit-to-orbit space vehicle to be launched and recovered from a space station, or for a vehicle capable of taking off and landing on a planet. Program will be conducted by Lear's Advanced Engineering Division in Grand Rapids.

North American Gets Space Particle Study

Los Angeles—North American Aviation Missile Division has been awarded two U.S. Army research contracts through Los Angeles Ordnance District. One contract is for laboratory study in which minute particles, simulating micrometeorites found in outer space, will be blasted against various materials to determine impact effects. Other covers interaction of surface materials and high temperature boundary layers.

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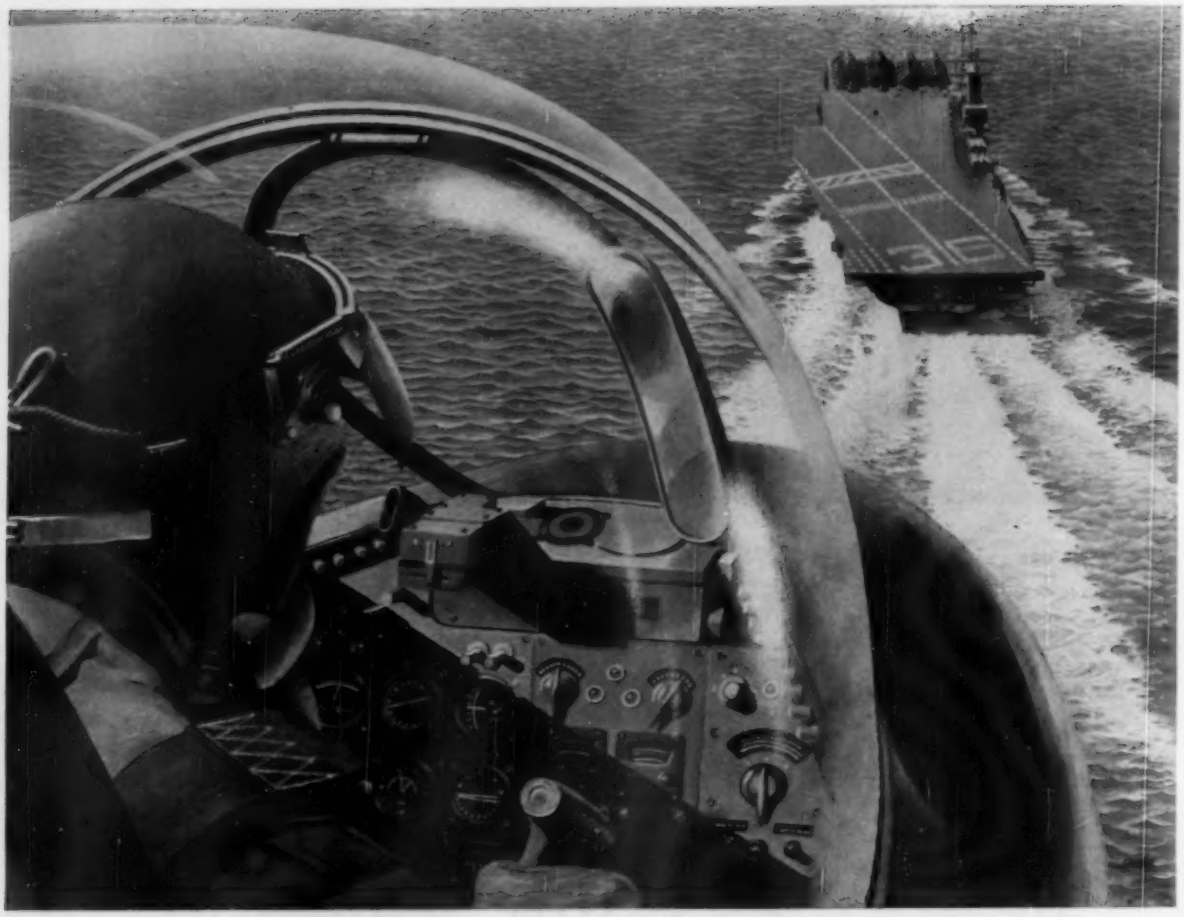

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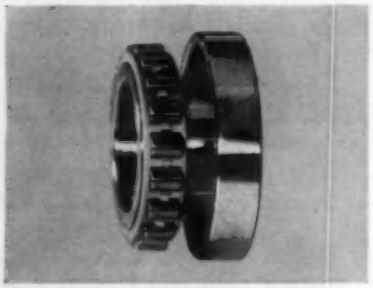

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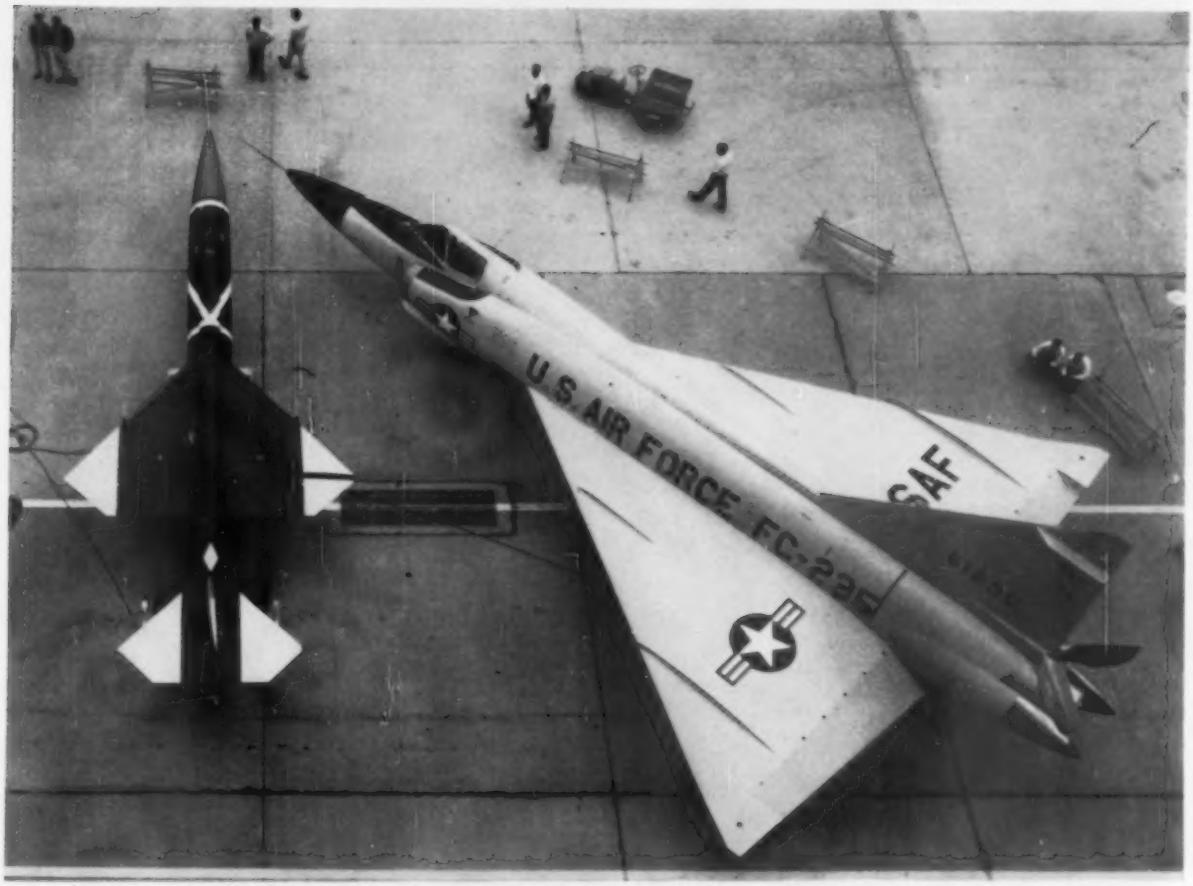


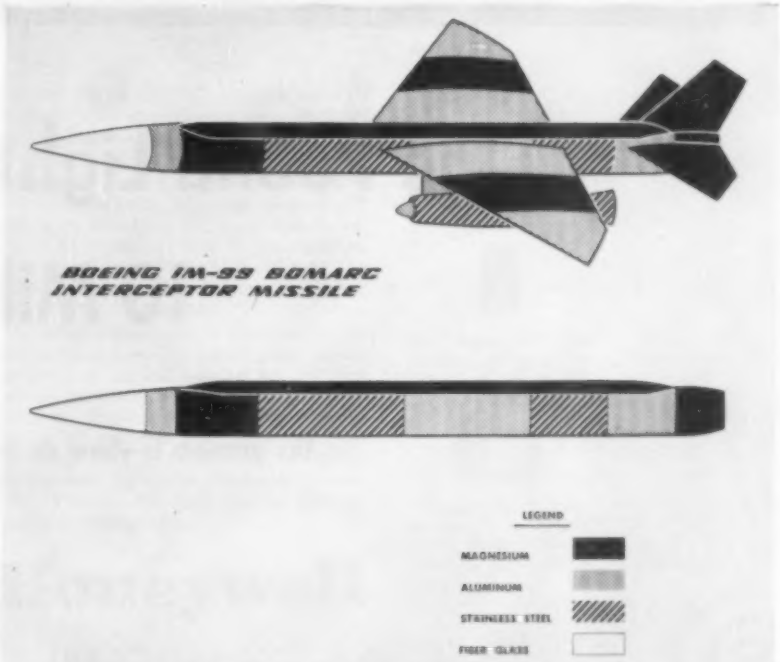
BOMARC missile (left) will complement the Convair F-102 interceptor in North American Air Defense Command operations.

Eglin Range

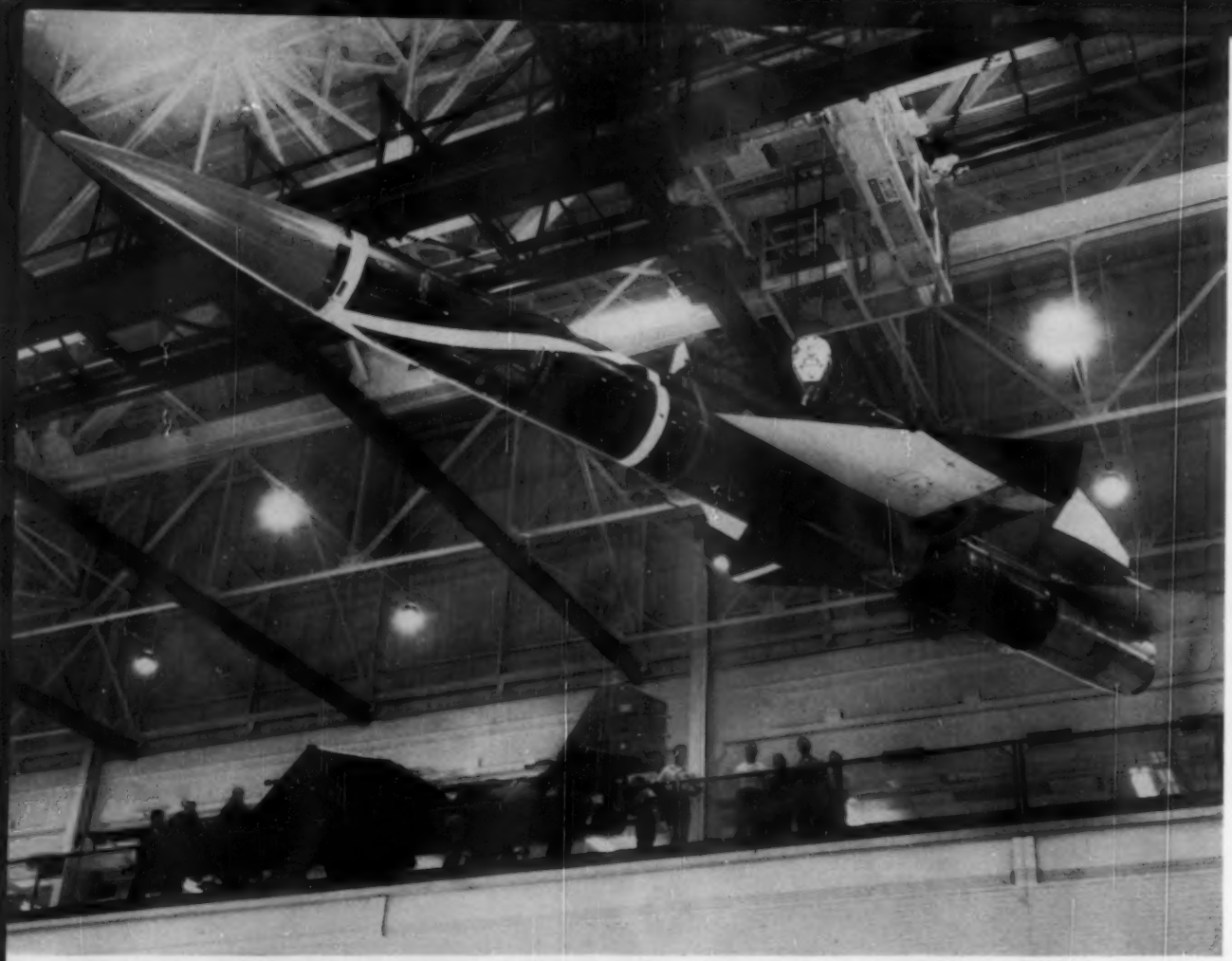
Range stations are being built at Eglin, Cape San Blas and Anclote, near Tarpon Springs, Fla. Santa Rosa base includes fuel storage area, squadron operations center, heat and power plant and other support installations. Cost of Bomarc support buildings at Santa Rosa Island and Hurlburt Field is about $4.3 million. Missile delivery is to 4751st Air Defense Missile Wing.

Super Bomarc IM-99B, slated for operational use in 1960, will have a solid-rocket sustainer engine. This is expected to increase Bomarc's range to 400 mi. IM-99A launcher is Aerojet-General liquid propellant rocket; sustainer is a pair of Marquardt RJ43-MA-3 ramjets. Missile is designed for Mach 2.5 speed at a cruise altitude of about 60,000 ft. Ground environment and support equipment will be common to both IM-99A and the Super Bomarc. Bomarc is 47 ft. 4 in. long. Chopped delta planform wingspan is 18 ft. 2 in.

Main body shell has 33 in. dia. Missile uses wingtip ailerons for roll control and banking turns.



MAGNESIUM, aluminum, stainless steel and fiber glass are used in fabrication of Bomarc.



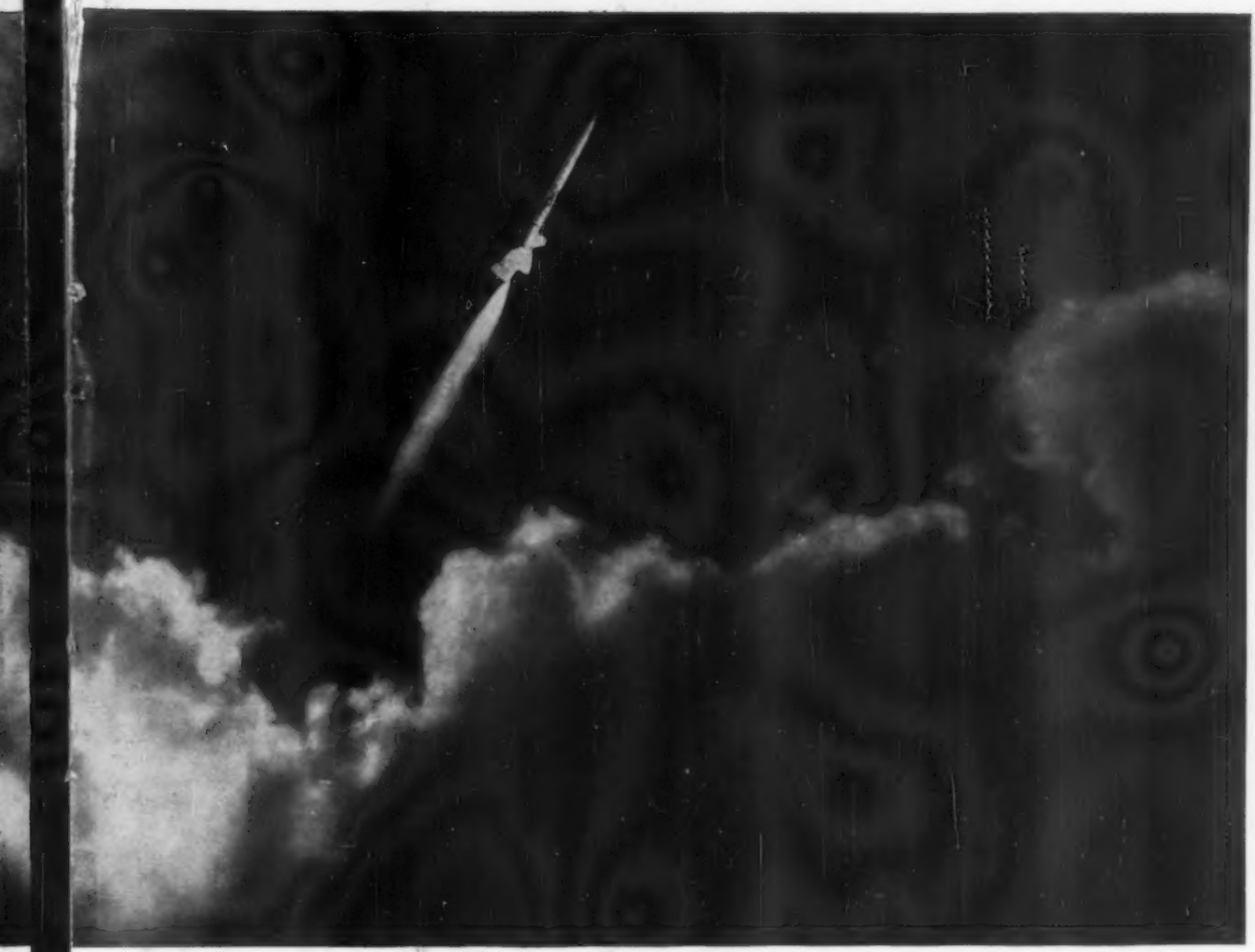
FIRST Boeing Bomarc surface-to-air interceptor missile is readied for shipment to Air Proving Ground Center, Eglin AFB, Fla.

USAF's Bomarc Readied for Shipment to

COL. R. J. Walling, USAF plant representative at Boeing (right), and Lysle A. Wood, Boeing vice president and general manager of the Pilotless Aircraft Division, inspect Bomarc.

Boeing Bomarc IM-99A surface-to-air interceptor missile, which will be tested at Air Proving Ground Center missile range, Eglin AFB, Fla., is ground-tested at plant and components are broken down for separate shipment. USAF missile currently is center of comment as a possible NATO nation area defense weapon (AW Aug. 4, p. 62) and also is involved in Department of Defense controversy involving a selection between Bomarc and Army's Nike Hercules (AW Aug. 11, p. 21.).

Bomarc has a range of about 200 mi. and is controlled by SAGE (Semi-Automatic Ground Environment) system until missile's homing radar locks on target and takes over guidance. Test range, now under construction, will cost about $120 milion, including costs of Bomarcs which will be used there. Range extends southward about 350 mi. into the Gulf of Mexico, is about 150 mi. wide and will be operational from Santa Rosa Island by next summer. Missiles are assembled at Eglin's Hurlburt Field, then barged to Santa Rosa Island.



The missile man's rough rule of thumb, "one pound lighter—10 miles farther," cogently points up the importance of miniaturization in increasing missile range and performance.

The successful miniaturization of any given component, however, is limited by a manufacturer's ability to produce the given component uniformly and in quantity.

In the seventeen years Honeywell has been designing and producing airborne control systems, miniaturization techniques have received unremitting attention. Special production and quality control techniques have been developed. Laboratory control methods have been applied to production lines to achieve desired product uniformity and quality.

One recent miniaturization achievement at Honeywell is the famous Gnat Gyro—a complete flight control rate gyro weighing only 3.8 ounces. Another, the new Honeywell Miniature Integrating Gyro (MIG) weighs only 8 ounces. The gyro it replaces weighs 100 ounces—a 92% reduction!

In a completely different area, Honeywell has developed a Transistor Power Converter, the size of a candy bar, and weighing 12.1 ounces. It replaces dynamotors five times as large, weighing 5 pounds—yet it delivers the same performance in transforming one DC voltage to another.

Miniaturization is another area where Honeywell's accomplishments make it a logical choice for further missile systems development and production. If you have a problem in the design of systems or components for aeronautical control, call or write Honeywell, Military Products Group, 2753 Fourth Avenue, South, Minneapolis 8, Minnesota.

Gnat Gyro—flight control rate gyro. wt.: 3.8 ounces

MIG Gyro—Miniature Integrating Gyro. wt.: 8 ounces

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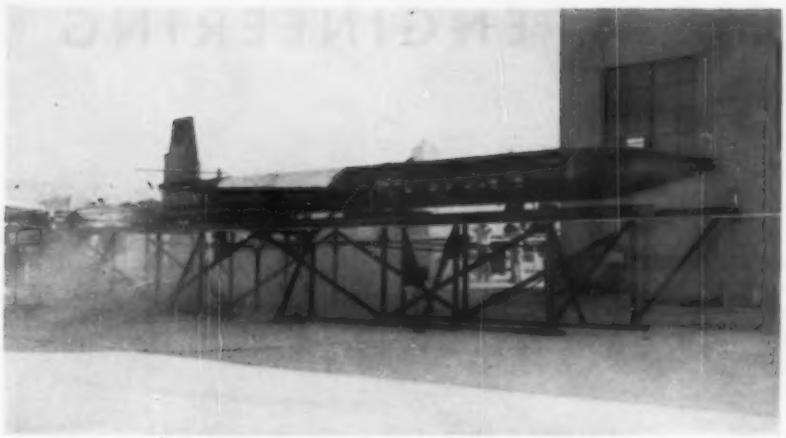

X-7 Avionics Get Shock Test

Lockheed Aircraft Corp.'s G-Shooter subjects the X-7 missile's avionic equipment to a shock of 18G acceleration in a span of 0.4 sec. Distance missile travels in test is about 2 ft. During test the X-7 is mounted on rails of the G-Shooter. Pressure of 2,100 psi. is built up behind piston for acceleration. Eight bands of nylon webbing are strung under rails for braking action. Four webs stretch and snap to prevent rebound; remaining four webs are added safety factor. Tests are conducted by Lockheed Missile Systems Division at Holloman AFB, N. M.

U.S. Navy Schedules Polaris Test Firing

San Francisco—First firing of a full-scale Polaris fleet ballistic missile test vehicle, utilizing Polaris configuration, will be made about the first week in September.

However, U.S. Navy, under orders from Department of Defense, is "de-emphasizing" the firing. Missile exploded shortly after launching in previous test at Cape Canaveral, Fla. (AW May 19, p. 28), although Navy said breakup was "expected."

The Polaris is a two-stage missile with separation of the second stage taking place about one quarter of the way down from the black circular stripe marking the upper end of the main missile body. In this black stripe there are four of what appear to be thrust-vectoring engines that would control the missile during second stage flight.

Solid-fueled Polaris, which is expected to be operational in 1960, is designed to be fired from submerged submarines. Missile has inertial guidance system developed by General Electric Co. and Massachusetts Institute of Technology; prime contractor is Lockheed Aircraft Corp. Range is about 1,500 mi.

Ballistic Nose for Snark

Washington—Gray-painted operational versions of Northrop SM-62 Snark now being delivered to the Air Force are equipped with ballistic nose sections which separate from the rest of the missile to make the final run onto the target along an unpowered free fall trajectory. Separation line is just forward of the wing root leading edge. Ballistic nose has three stabilizing fins, one on top and two low on the sides.

As the target is approached, guidance and flight control systems fly the Snark into a zero gravity ballistic trajectory ending at the target. Nose then separates. Remainder of the missile becomes unstable, pitches up and disintegrates.

Terminal dive target approach by the entire missile was considered and abandoned. Dive would carry the subsonic Snark to high supersonic speeds, causing loss of control effectiveness and structural overloads. Flat, power-off, subsonic approach would make counteraction by enemy point defenses too easy. Design compromises to make supersonic dive possible were unacceptable.

USAF ground radar operators report that Snark cannot be detected by current military equipment from any angle at ranges beyond 50,000 ft. Radar reflectivity is so poor that test missiles fired at USAF Missile Test Center, Cape Canaveral, Fla., must be equipped with radar beacons to paint a blip on tracing radar scopes. Reflective area is set at one-twentieth that of the Boeing B-52 and one-tenth that of B-47.

CABLE and WIRE LEADS

by HOWARD E. PENDERGAST
Technical Director Rex Corporation

Factors that influence choice of conductors

Resistance, cost, weight, tensile strength and solderability are important considerations in selecting the best conductor for an application.

Resistance is perhaps the most vital factor. The primary function of a conductor is to carry electrical energy with minimum loss. The resistance of the conductor and its insulating medium influence the degree of potential drop. Resistance is a function of temperature. Typical values for conductors at room temperature are shown below:

Material	Resistivity
Copper	1.72×10^{-6} ohm cm
Aluminum	2.82×10^{-6} ohm cm
Silver	1.62×10^{-6} ohm cm

Cost is chiefly a function of the metal used. Silver would be the obvious choice but for its expense. Copper usually combines the best cost-resistivity ratio.

Weight. Where weight is extremely important and lower conductivity is acceptable, aluminum can be considered. It is preferred for high power transmission lines, for example.

Tensile Strength — "cladding" techniques permit the combination of two metals — one for strength, the other for conductivity. Thus, copper clad steel is now popular for applications calling for high tensile strength.

Solderability is of critical importance for permanent connections. Tin coating by electro-deposition or dipping before final sizing and stranding of conductors is now universal. A growing demand for tin overcoated stranded conductors is prevalent. This offers reduced labor costs during assembly but substantially lowers flexing life and flexibility of the basic stranded conductor. Silver plating is now common with increased demand for high temperature wire. Because manufacturing temperatures are higher than the melting point of tin, silver has been selected as an aid to soldering and a protection for copper. Various alloys of nickel both as plating and cladding are under study as replacements for silver plating. Nickel's high melting point and lack of wicking promise to reduce soldering failures with high temperature wires.

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BRISTOL Model 192 military helicopter began hovering tests last month. Forward flight trials are scheduled for this month.

Transmission Design Cuts 192's Weight

By John Tunstall

London—Weight-saving potential of a transmission development designed to assure uniform tooth loading has been traded for reliability in the Bristol 192 military helicopter. This design philosophy was one of the points mentioned in an outline of the company's development program by Raoul Hafner, chief helicopter designer, in a recent interview with AVIATION WEEK.

Bristol's new twin-turbine helicopter (AW July 21, p. 24), which has a tandem rotor configuration with H-type transmission, began hovering tests last month and was due to start forward flight trials this month. The company claims the 192 to be the largest military helicopter in Europe, the heaviest to fly with purely manual, spring biased controls and the first to maintain cruising flight on one engine. The machine has a cruising speed of 120 kt., a gross weight of 18,000 lb. and a maximum payload of 6,000 lb.

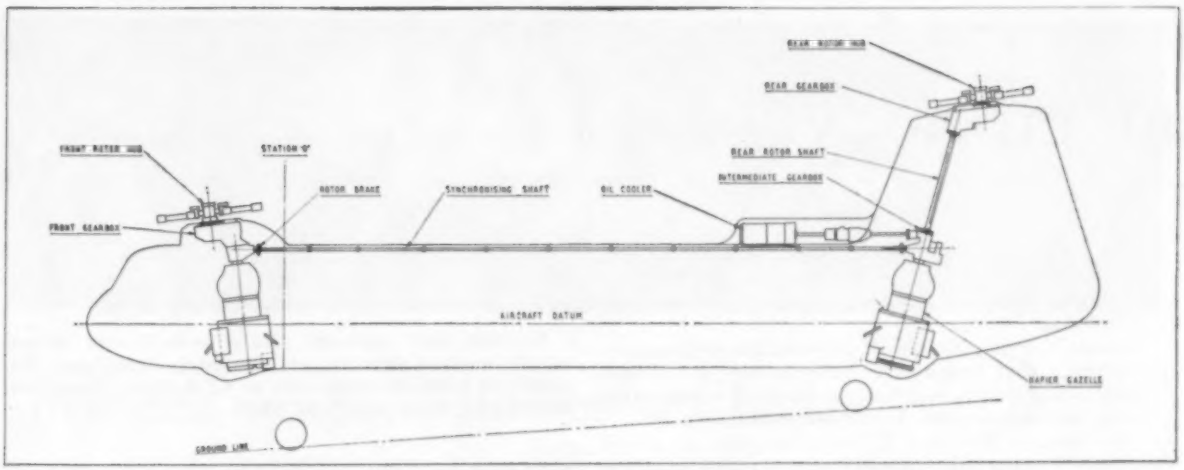
Royal Air Force order for the machine is believed to exceed 20. Bristol intends to demonstrate the aircraft in Europe early next year.

Important aspect of the Napier Gazelle Series 2 turbines, which were specially developed for helicopter applications, is the wide thrust spread between cruising and emergency ratings. These extend from a maximum continuous cruise rating for twin engine operation of 920 hp. to a 2½ min. emergency rating of 1,650 hp. The one-hour maximum continuous rating is 1,300 hp. With this operating range, Bristol claims a constant world-wide performance. Engine diameter is 28.5 in., engine weighs only 0.5 lb. per hp.

Hafner believes the configuration, slightly scaled up, has a big civil potential owing to its indiscriminate loading feature. He disclosed details of a current design study for a bigger, 35-seat version of between 22,000 and 25,000 lb. gross weight. With stub wings between the ventura contracta of the two rotors—giving a 40-60% wing/rotor lift ratio—a top speed in excess of 160 mph. is expected. (Ventura contracta is contracted diameter of airstream below rotor. Because of contraction it is possible to locate wing clear of rotor downwash.) The machine would have a conventional fixed wing and tricycle undercarriage with the main wheels mounted on the stub wings slightly after of the center of gravity. Outboard section of the wings would be removable to suit applications where the hovering role was dominent. Present Gazelle engines, stretched to a 2,400 hp. ratio, would be available for the machine which is designated the 194. It would use the same rotors.

Referring to safety and reliability aspects of the 192, Hafner said Bristol is firmly in the school that believes in mechanical transmission systems for helicopters.

Part of this philosophy, he explained, was the continued use of straight spur gearing in reduction after the engine, and the location of a minimum number of gears after the freewheel. This, he emphasized, was of prime importance to ensure freedom of the rotor system to rotate in the event of failure of one engine and its associated gearing. In the 192 it was already down to 12, Hafner said, and in later designs it would be reduced even further, until all reduction to rotor speed would be done at the engine mounting. This trend toward concentrating



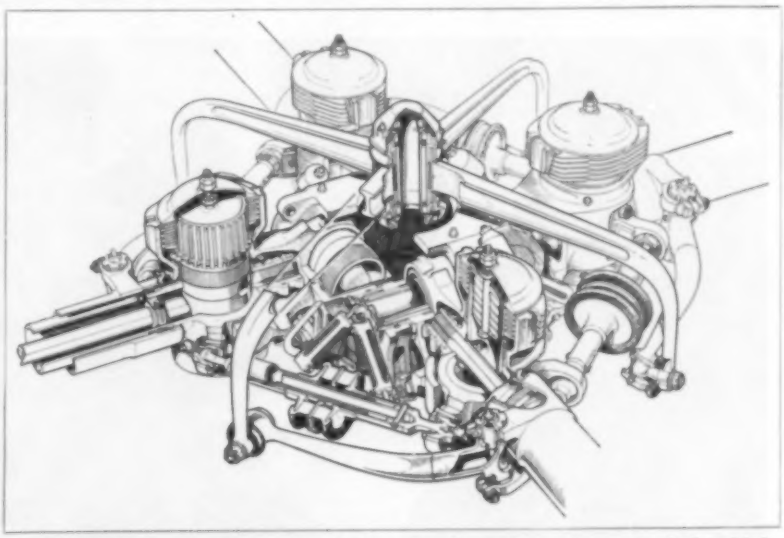
MOST of engine, transmission and fuel weight of 192 is located under two rotors to lower bending stresses in the fuselage.

the reduction at the engine increased the torque and hence the weight of the rotor drives but it was a worth-while concession to safety, Hafner said.

New design in the Bristol transmission system stems from development of a strain gage alignment technique in conjunction with an adjustable geared rig which simulates the drive assembly. The rig determines for the first time the load distribution along the flanks of all the gear teeth in the system under all load conditions. Based on the load picture obtained, using gages thin enough to pass undamaged through backlash clearance on the trailing gear flank, the shafts are pre-skewed to accommodate the deflection of the tooth and windup of the gear boxes and mountings under load.

The pre-skew is then marked on the production drawings.

Surface evidence of the uniform load distribution obtained on all flanks of one of the 192's two-stage 12:1 reduc-



CONCENTRIC sleeves connect rotor blades to drag lines. Outer sleeve, attached to blade, is free to rotate on inner one. Pair of needle roller bearings takes bending loads.

ROTOR thrust differential makes indiscriminate loading feasible, a factor that suggests a civilian potential for the 192.

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they range from the ocean floor to deep space

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Today at Chance Vought, development work fans out into virtually every known dimension of weapon systems.

ANTISUBMARINE WARFARE (ASW)

Vought is engaged in ASW studies under the Office of Naval Research and the Bureau of Aeronautics. Extensive research and development is being done in the vital detection and classification phases. Goal is to bring detection abreast of destruction capabilities.

Vought applies to this work a pre-eminent background in sea-going missiles: 10 years' experience in installing, testing, observing Regulus *Fleet missiles; an intimate knowledge of submarines.*

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Vought is actively studying space research vehicles. Projections of this work point to man in space. Vought's Astronautics strength is experiencing rapid growth: up to a 50-fold increase in less than two years in some groups. Through this astronautics nucleus, Vought swells the space capability of its entire engineering organization.

Vought's major contribution to U. S. man-in-space technology: a rich source of cockpit and capsule knowledge.

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This body of Vought specialists is determining future weapons requirements; defining new areas for closer evaluation. Under way are studies of nuclear-powered missiles and other original applications for today's explosion of propulsion possibilities.

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Preliminary Design Engineer

Capable of turning approximate dimension, thrust, payload and mission information into usable configurations. Requires the mechanical ability to provide for separation of stages; a good feel for missile weight and balance; ability to devise reliable, uncomplicated control systems.

Qualified scientists and engineers who would like to evaluate more thoroughly the opportunities afforded today at Chance Vought are invited to write in confidence to Mr. A. L. Jarrett, Manager, Advanced Weapons Engineering, Dept. M-14.

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Vought Vocabulary

ac′cu·ra·cy: *guided all the way, this long-range missile pinpoints distant, hard-to-hit targets*

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Soviet Atomic Plane?

Vienna—"Freiheit," a daily newspaper published in the Communist East German city of Halle, reports that the Soviet Union already has built an atomic-powered aircraft. In an article published under the title, "Atomic Energy and Transportation," the newspaper said:

"In the Soviet Union, the first atom-powered airplane has been built. In principle, it is a jet plane in which the air sucked in for the thrust is being heated to approximately 1,000C by means of a special nuclear reactor. Thus, a higher discharge velocity is achieved. Radiation protection is to be provided by a new light alloy developed by Soviet scientists."

D. (Sox) Hosegood, told AVIATION WEEK that the hovering tests had gone extremely well, although some sticking of the chassis oleos, which could have led to ground resonance, caused some slight delays.

The aircraft was flown at 14,000 lb. below 50 ft. within the ground cushion.

Tests included turns through 360 deg. in both directions and sideways movement in both directions. Maximum forward speeds of 20 kt. were attained.

Response to the throttle, Hosegood said, was extremely good. Controls were light and there was a marked reduction in vibration levels in the fuselage and particularly on the controls compared with the 173 piston-engine version.

The rotor hub and the manual control system are distinguishing features of all Bristol helicopters. The blades are connected to the drag hinges by concentric sleeves. The outer sleeve which is attached to the blade is free to rotate on the inner one, bending loads being taken by a pair of needle roller bearings. But the centrifugal load is carried by a tie rod which obviates the use of heavily loaded thrust bearings and reduces the control forces needed to twist the blade. The tie rod is formed from a cluster of bars to reduce the torsional stiffness and to give added safety in the event of metallurgical defects.

Apart from the switch to gas turbines, the structure and transmission of the 192 follow closely that of the piston-engined 173 series. This series, which first flew in 1952, was underpowered and had three-bladed rotors (later four-bladed).

Principal modifications to the 173 structure include mounting the tail fins from negative dihedral planes to lower the center of pressure of the fuselage in order to uncouple the yawing and rolling moments. Height of the rear rotor above the forward rotor has also been increased to reduce interference between the two rotors at low forward

New Thermocouple Measures Up To 3600° F.
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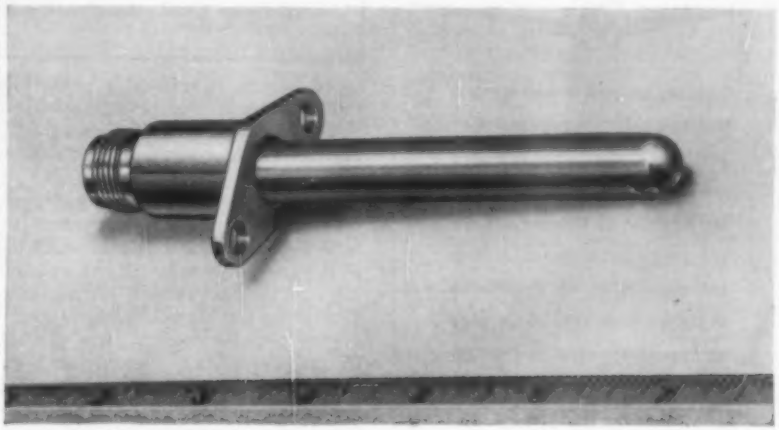

A new, high temperature thermocouple probe, developed by Thermo Electric, promises to solve several serious problems of airborne or test stand temperature measurement. This probe was designed for use in the high velocity gas streams of jet engine afterburners, and ramjet and rocket exhausts. The key to its performance is a cermet (ceramic-metal combination) support tube and radiation shield.

This support tube replaces the need for water or air cooling. As a direct result, conduction errors due to cooling are eliminated and radiation losses to cold duct walls are reduced about 60%. Other disadvantages of water cooling—water supply, conduit, additional space needs, and other installation difficulties, are also eliminated. Equally important are the probe's conductors—Platinum 6% Rhodium/Platinum 30% Rhodium up to 3000°F. and Iridium/Iridium Rhodium up to 3600°F.

Thermo Electric's initial objective with this probe was a life in excess of five hours at temperatures of 3000°F. or higher. It has already been tested at 3000°F. in a Mach 1 gas stream for 1½ hours without failure. Tests are still under way to determine the ultimate operating limitations of the probe's structural elements.

Other Applications

Possible applications of this type of unit, however, are much wider in scope. Both construction and conductors can be varied to meet a great variety of temperature measuring problems. The support tube itself, for example, can be formed to almost any shape. Other tube materials are also being investigated.

If you'd like further information on this thermocouple and how it can be adapted to your particular needs, contact Thermo Electric. Its development is typical of T-E's continuous progress in the field of high temperature measurement. Our extensive research and engineering facilities provide a complete service for the aircraft industry. Call on us. The answer to your problem may be waiting for you.

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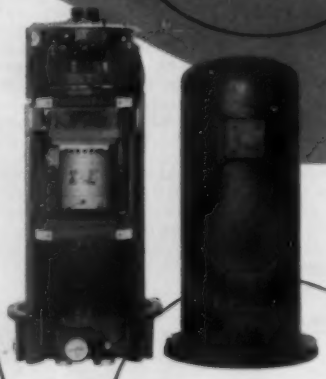

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RECOGNIZED LEADER IN GALVANOMETERS—TELEMETRY, PRESSURE AND VIBRATION INSTRUMENTATION

tion gears was shown to AVIATION WEEK.

Hafner pointed out several reasons why the company had stayed not only with the tandem-rotor, twin-engine configuration, but with the H-type transmission layout. The configuration:

- **Minimized weight penalties** of the square-cube law relationship between rotor diameter and weight. Two small rotors can operate with lower disk loadings than possible with an equivalent single rotor, which lowers vibration levels.
- **Increased the center** of gravity movement to several times that possible with a single rotor configuration by using rotor thrust differentially. As a result, indiscriminate loading without flight stewards is feasible.
- **Greater efficiency** in hover as no power is needed to drive a torque reaction rotor. Relative advantages claimed by Bristol for the H-type transmission include:
- **Lower bending stresses** in the fuselage because most of the engine, transmission and fuel weight is located directly under the two rotors.
- **Lower drag fuselage.**
- **Maximum utilization** of fuselage between rotors. Clear cabin length is 24 ft. in a fuselage length of 54 ft. 4 in. Fuselage has an ovoid section approximately 5 ft. square.
- **Shortest possible** drive shafts between rotors and engines.

Achievement of indiscriminate loading and the elimination of flight stewards was a first requirement of civil helicopter operation, Hafner told AVIATION WEEK, and was worth exploiting on that consideration alone.

Synchronizing Shaft

The H configuration calls for a long, horizontal synchronizing shaft to keep the two rotors in phase and to couple the two rotors in the event of one engine failure. In this condition the 36-ft.-long shaft has to transmit 960 hp. maximum, but in normal operation the shaft is only lightly loaded with the torque differential between the two rotors. Bristol engineers have reduced the weight of this shaft by: stepping up the speed to 3,500 rpm.; using tube of 80 tons psi. ultimate tensile strength steel with 2-in. OD and ¼-in. thick which is polished outside and honed internally to improve the fatigue life; and by rubber-bonding the inner bearing races to the tube. To meet the whirling condition, the shaft is mounted from 10 plain roller bearings. Unusual method of mounting the bearings halved the weight of shaft. It eliminates the need for welded or riveted points along the tube and enables the bearings to accommodate deflections of the shaft due to wracking of the fuselage.

Bristol's chief helicopter pilot, C. T.

teed complete private financing. Airco was formed to build de Havilland's DH121, while Bristol Aircraft Co. and Hawker Siddeley announced a joint proposal to build Bristol's 200 medium-range jet.

The government finally chose the DH121—BEA's original preference. A contract will be signed when detailed designs have been submitted to BEA, Airco says.

British Test Visual Glidepath System

London—Visual glidepath system developed by Royal Aircraft Establishment at Farnborough is being installed for operational evaluation at five airfields of the Ministry of Transport and Civil Aviation.

System consists of two pairs of units arranged to form lighted wingbars on both sides of the runway. First pair is located 500 ft. along the runway from the threshold and the second pair 500-1,000 ft. further on, indicating touchdown area.

Units are flat rectangular boxes projecting light toward the approach through a 4½ ft. horizontal slit. Each wingbar has three of them spaced at 8 ft. intervals, the inner one being about 50 ft. clear of the runway edge.

Optical system projects white light over the upper sector, red light over the lower sector, with a gradual change of color over a half-degree sector. Elevation of the transition sector above the horizontal is set for the aircraft's normal descent path.

In making an approach, the pilot should be able to see the white lights of the nearer wingbars (to avoid undershooting touchdown area) and red or pink lights of far wingbars (to avoid over-shooting).

One system has already been installed at Blackbushe, Hampshire, and pilots using it are being asked to fill out questionnaires on their experiences. Others are being installed at Aberdeen, Belfast, Liverpool and Prestwick.

Vickers Vanguard Structure Modified

London—Local stiffening of the Vickers Vanguard wing, chassis and fuselage to accommodate an extra 4,000 lb. payload, at the expense of some range, will drop seat-mile costs, the Vickers Aircraft Co. claims.

Structural modifications will be incorporated in all but the first 12 aircraft off the line. Using a 139-seat high density configuration, the new Vanguard direct operating costs (ATA formulae) will drop to two cents per passenger seat-mile over stages as short as 100 mi. and to one cent on distances exceeding 900 mi., according to Vickers.

Seating configuration in the high density version features a seat pitch of 36 in. and seats six abreast. The tourist version seats 97.

Maximum takeoff weight of the new Vanguard remains unaltered at 141,000 lb. while the maximum landing weight is raised to 121,000 lb. and the maximum zero-field weight to 112,000 lb. Underfloor freight space of 1,360 cu. ft. also remains unaltered, but with its new maximum payload of 29,000 lb. the still air range drops from 2,600 statute mi. to 2,200.

Principal region needing stiffening to accommodate the extra payload is the bottom center of the fuselage. Primary chassis components remain unaltered.

Company also revealed plans for an all-freight version incorporating the modifications. Maximum takeoff weight of 150,000 lb. is envisaged with a 40,000 lb. payload. Floor of the new version will be strengthened, larger doors will be fitted and there will be no cabin windows. Provision for air conditioning will be less sophisticated but the basic equipment carried on the passenger versions will be fitted.

First Vanguard is expected to make its maiden flight in November.

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CPA 10

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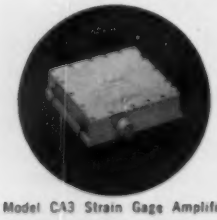
NON-LINEARITY AND HYSTERESIS: ±½%

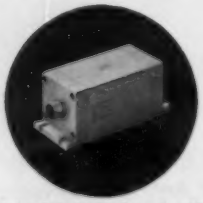
OPERATING TEMPERATURE: −65° to +165°F.

OUTPUT IMPEDANCE: 10K ohms (100K recommended load)

WEIGHT: 14.5 ounces, approximately



Model CA3 Strain Gage Amplifier



Model CA5 Strain Gage Amplifier

For complete data, write to:

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12401 W. Olympic Blvd., Los Angeles 64, California

J85 Completes Test

General Electric's J85 gas turbine engine has just passed its 15 hr. preliminary flight rating test qualifying it for production for missiles. General Electric says the J85 is in the 2,000 lb. thrust class, confirming an Aviation Week estimate (AW March 3, p. 213).

Applications for the J85 include the Northrop T-38 trainer, North American UTX Sabreliner utility aircraft and McDonnell Green Quail air-to-surface missile.

speeds where it reached a peak. Pilot tendency to fly this configuration tail-down has been met by coarsening differential throttle control of the rear engine.

Replacement of the piston engines by the Napier Gazelle free-power turbine engines called for no major change in the transmission layout. Main advantage of turbines which Hafner cited, apart from the big net saving in specific engine plus fuel weight, was the ability to torque-limit the engines. This permits a constant worldwide performance irrespective of height or temperature variations. It was of primary importance in helicopter operations, Hafner said.

Elimination of cooling fans and starting clutches are other weight-saving features of the new prime movers and, due to smoother torque characteristics, there is no need to protect the transmission from peak torque oscillations which had developed in the piston engine configuration.

BEA Free to Buy De Havilland 121s

London—British government has approved British European Airways proposed purchase of 24 de Havilland DH-121 jet airliners from a consortium known as Aircraft Manufacturing Co. (Airco).

Harold Watkinson, Minister of Transports and Civil Aviation, says the aircraft will cost $81-million and will be delivered between 1964 and 1966.

Conditional approval of the contract was given in February (AW Feb. 17, p. 41). Airco, consisting of de Havilland, Fairey and Hunting Aircraft, was formed at the end of last year in a successful effort to get the BEA contract.

When BEA announced specifications for a medium-range jet airliner in August, 1956, four companies submitted separate designs. But the government, encouraging amalgamations within Britain's aircraft industry, said the order would go to the company that "pooled its resources with others" and guaran-

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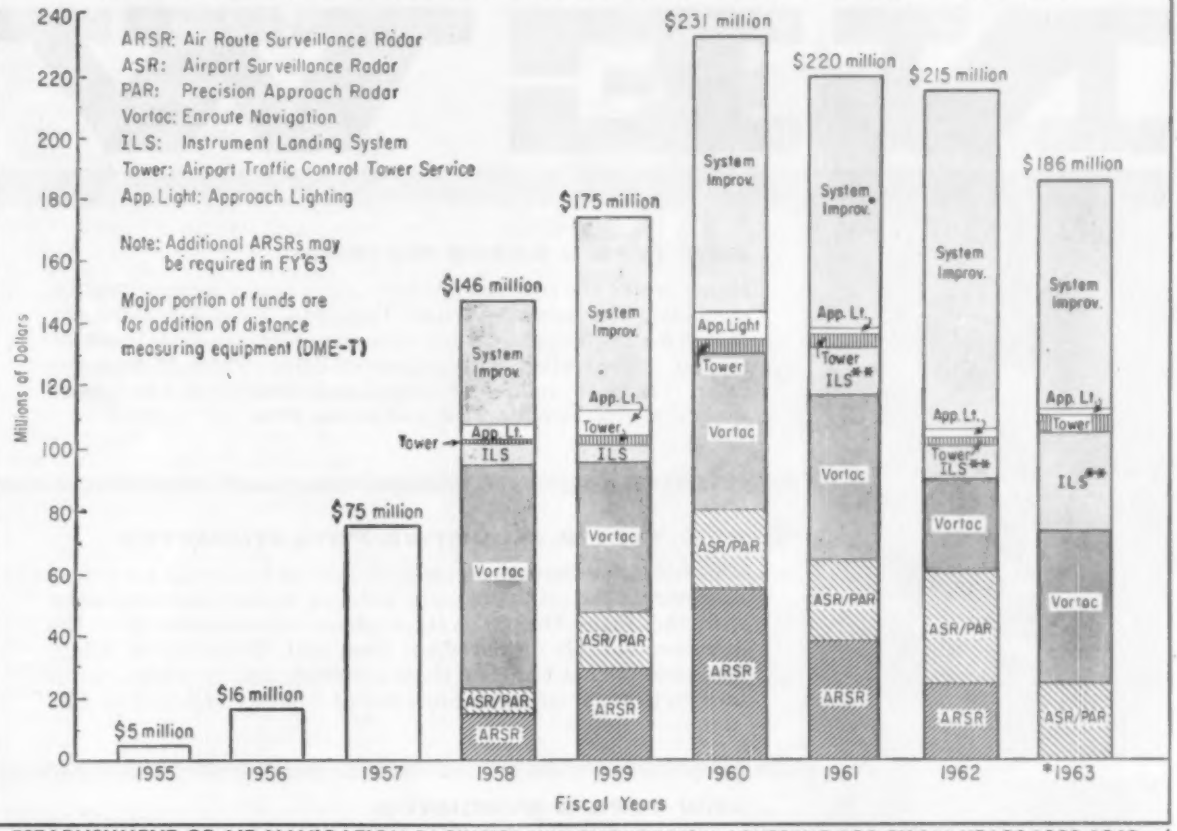
NORTH AMERICAN AVIATION, INC.

PAST AND PROJECTED CAA EXPENDITURES FOR AIR NAVIGATION FACILITIES

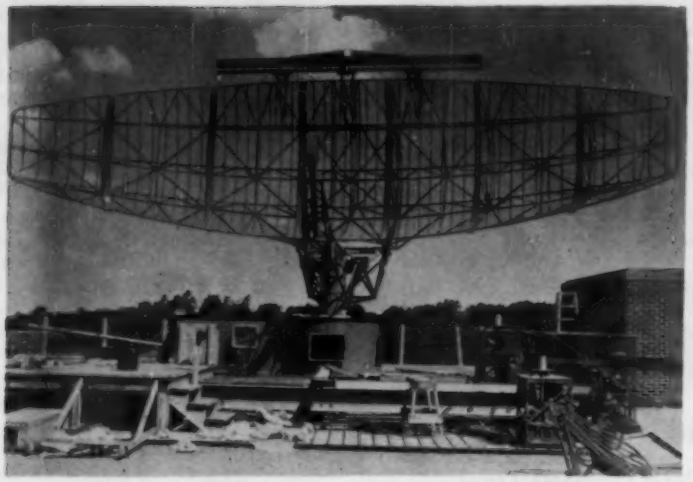


ESTABLISHMENT OF AIR NAVIGATION FACILITIES IMPLEMENTATION SCHEDULE FOR FISCAL YEARS 1959-1963

FACILITIES OR SERVICES	Total Quantities Thru FY 58	In Plan	Thru FY 63	FY 1959 Qty.	FY 1959 Cost	FY 1960 Qty.	FY 1960 Cost	FY 1961 Qty.	FY 1961 Cost	FY 1962 Qty.	FY 1962 Cost	FY 1963 Qty.	FY 1963 Cost
1. Long Range Radars (Including Joint Use)					28,835,000		56,450,000		38,000,000		23,750,000		—
Air Route Surveillance Radar (ARSR)	40	60	100	16		18		16		10		*	
ATC Radar Beacon	—	100	100	43		31		16		10		*	
2. Terminal Area Radar					17,545,000		24,280,000		25,060,000		26,640,000		23,560,000
Airport Surveillance Radar (ASR)	62	76	138	19		17		12		16		12	
Airport Surface Detection Eqpt. (ASDE)	—	30	30	10		—		10		—		10	
Precision Approach Radar (PAR)	23	—	23	—		—		—		—		—	
ATC Radar Beacon	—	189	189	5		50		50		49		35	
3. Airport Traffic Control Tower Service	224	69	293	23	2,579,000	16	2,200,000	10	1,600,000	10	1,700,000	10	1,800,000
4. Air Navigation Facilities (VORTAC)					50,816,000		53,191,000		54,582,000		39,740,000		48,850,000
VHF Omniranges (VOR)	634	43	677	13		10		10		—		10	
Backfit VOR with TACAN rho /theta	299	337	636	150		100		67		—		20	
VORTAC's (theta /rho /theta)	47	526	573	62		100		120		120		124	
VOR Test Signal Facilities (VOT)	31	79	110	33		26		—		20		—	
5. Instrument Landing Systems					3,675,000		—		16,420,000		10,750,000		36,225,000
ILS only	195	40	235	19		—		11		—		10	
Backfit ILS's with TACAN rho	—	225	225	—		—		50		50		125	
ILSTAC	—	20	20	—		—		10		—		15	
6. Approach Lighting					9,002,000		5,575,000		420,000		3,180,000		500,000
Standard Approach Lighting (ALS)	89	146	235	80		45		—		21		—	
Sequenced Flashing Lights (SFL)	36	47	83	7		10		10		10		10	
Sub-Total (Major Facilities)					112,452,000		141,696,000		136,082,000		105,760,000		110,935,000
Other Improvements to System													
1. Long Range Radars					6,649,000		18,824,000		18,816,000		15,820,000		673,000
2. Terminal Area Radars					4,119,000		8,324,000		12,666,000		13,877,000		7,375,000
3. Air Route Traffic Control Centers					11,029,000		15,231,000		19,178,000		39,953,000		12,183,000
4. Airport Traffic Control Tower Service					4,353,000		1,619,000		1,113,000		486,000		455,000
5. Air Traffic Communication Stations					7,126,000		8,849,000		8,425,000		7,941,000		7,165,000
6. Int'l. Air Traffic Comm. Stations					2,155,000		2,275,000		4,316,000		4,847,000		2,751,000
7. Air Navigation Facilities (VORTAC)					1,156,000		13,400,000		9,041,000		10,673,000		17,280,000
8. Instrument Landing Systems					3,271,000		4,701,000		2,273,000		2,719,000		2,080,000
9. Approach Lighting					406,000		373,000		703,000		255,000		385,000
10. L/MF Facilities					1,114,000		446,000		533,000		3,334,000		15,931,000
11. Intermediate Fields					1,933,000		612,000		2,545,000		1,176,000		2,538,000
12. Flight Insp. & Logistics Aircraft					11,714,000		8,855,000		980,000		4,643,000		3,000,000
13. Housing, Utilities & Miscellaneous					8,123,000		6,040,000		2,851,000		3,730,000		3,117,000
Sub-Total (Improvements)					62,548,000		89,749,000		83,440,000		109,403,000		74,935,000
GRAND TOTAL					$175,000,000		$231,445,000		$219,522,000		$215,163,000		$185,870,000

* Additional radars may be needed to obtain the required coverage.

AVIONICS



MAJOR items in the Civil Aeronautics Administration's avionic procurement program for the next five years will be long range air route surveillance radars (ARSR), left, and Vortac stations, right, which provide a combination of VOR and Tacan navigation services.

CAA Plans $.5 Billion Avionic Spending

By Philip J. Klass

Washington—Current expansion of federal airways facilities has thrust Civil Aeronautics Administration into the position of being the nation's second largest buyer of avionics equipment, just behind the Defense Department.

CAA is likely to hold this position for at least the next five years with projected expenditures of more than a billion dollars during this period, more than half of which will go to buy new avionic equipment.

During the coming year, CAA expects to spend $5 million just for replacement vacuum tubes—as much as the agency received from Congress for procurement of new avionic facilities four years ago.

The $175 million which CAA has been authorized to spend in Fiscal 1959 for construction of new facilities and modernization of existing facilities is an increase of approximately 20% from last year. Corresponding figure projected by CAA for Fiscal 1960 is $231.5 million, a 30% increase above the current year. In Fiscal 1961, CAA's projected figures begin to taper off, but only slightly.

However, these projections do not include provisions for buying semi-automatic traffic control data processing systems or automatic ground-air-ground communication systems (AGACS) which the Airways Modernization Board now has under development. If these programs proceed according to schedule, they should be ready for initial production by 1961-62. This could cause a healthy boost in CAA expenditures instead of a minor drop-off. In Fiscal 1958, CAA awarded 814 contracts, of more than $500, more than twice the previous year's figure. Estimate for coming year is around 1,100.

Slightly more than 50% of the above figures represents CAA buying of equipment and hardware from avionics manufacturers. Balance includes cost of constructing facilities, such as Vortac stations, to house and utilize the equipment. Here, for example, is a breakdown of Fiscal 1959 avionic procurement:

- **Radar:** $30.6 million.
- **Communications:** $16.0 million.
- **Navigation aids:** $43.6 million.

The foregoing figures, which total $90.2 million, would be slightly larger if Congress had not authorized CAA to buy some of its Fiscal 1959 needs in the closing month of Fiscal 1958.

Cost of buying and installing new Vortac stations and converting existing VORs to Vortac is the largest single item in the Fiscal 1959 program and is likely to remain the largest during the next five years except for Fiscal 1960 when it is shaded slightly by long-range (en route) radars. Another major item will be the backfitting of ILS instrument approach systems with distance-measuring portion of Tacan to provide what is called "ILSTAC."

Modernization of existing CAA avionic facilities provides an attractive business potential. For example, Texas Instruments was recently awarded a $2.5 million contract to modify existing airport surveillance radars to provide for moving target indication and automatic radar performance monitoring.

As a government agency, CAA procurement is subject to many of the same ground rules as those of the military services, but with two important differences that sometimes bring cries of anguish from some avionics manufacturers:

- **Competitive bidding:** Great bulk of CAA's buying is awarded on the basis of the lowest qualified bidder, whereas much of the military avionic buying is on a negotiated basis where price may not be the sole criteria.
- **Liquidated damages:** Practically all of CAA's contracts contain liquidated damages clause for delay in delivery. Amount of damages runs about 0.1% of equipment's price per calendar day of delay. Thus the contractor stands to lose all or most of his profit if he is 60-90 days late in delivery.

Avionics manufacturers naturally would prefer to take jobs without liqui-

CAA Operating Costs Up

Dramatic increase in CAA procurement of new air navigation facilities will be reflected in increase in number of persons needed to operate and maintain these facilities, and corresponding increase in annual CAA operating costs. The 25,218 people required for operation and maintenance in FY 1959 are expected to grow to 45,661 by FY 1963, and annual operating-maintenance costs for same period are expected to jump from $204.9 million to $487.5 million in FY 1963.

dated damages. Recently formed Electronic Industries Association (EIA) committee on CAA procurement practices has approached CAA to ask that liquidated damages clause be dropped, or that at least a maximum limit be set on amount of damages.

But CAA is "once bitten, twice shy" on the subject. In 1950, CAA dropped use of liquidated damages clause when industry claimed that it did not achieve the desired effect of accelerating deliveries. Shortly afterward the Korean war broke out and industry was deluged with military business. Many companies relegated their existing CAA business to a low-priority status with nearly disastrous results for the agency.

For example, one manufacturer was four years late in delivering VOR equipment. Another was five years late in delivering precision approach radar and four years late in delivering direction finding systems, according to CAA figures.

Following extensive analysis of contractor performance, CAA decided in the fall of 1955 to re-institute liquidated damages provisions in future contracts, although its study indicated that "unnecessarily meticulous" CAA inspection procedures and change orders contributed to delivery delays in some instances.

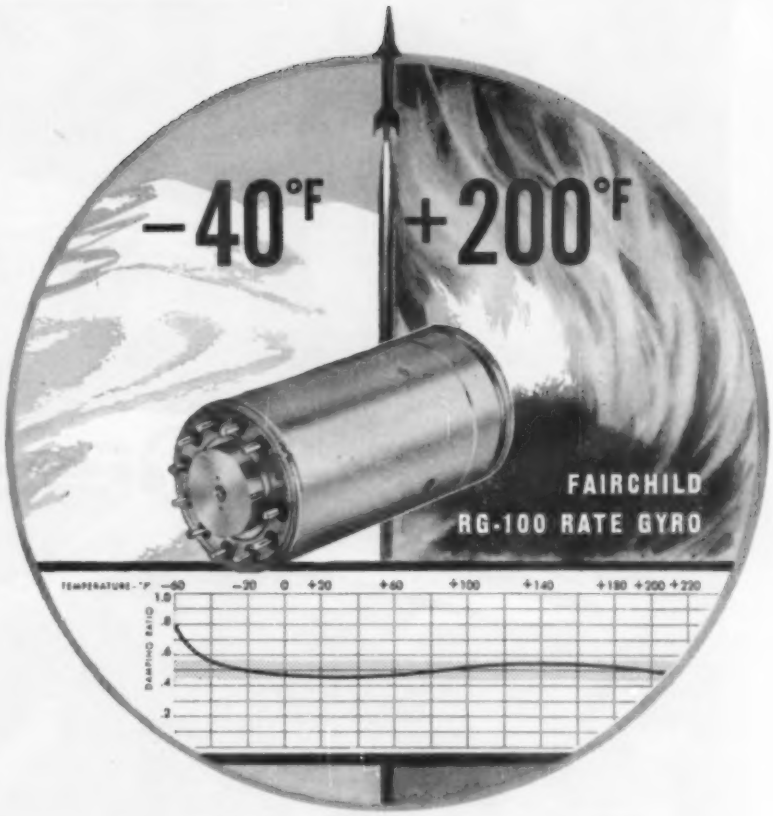
Delays Slashed

Since the liquidated damages clause went into use, CAA finds that contractor performance has improved significantly. How much of this improvement can be attributed to the damages provision and how much is due to easing of defense workload and the keen competition within the avionics industry which took place about the same time, is debatable.

Of approximately 700 major contracts awarded during Fiscal 1957-1958, nearly 500 have been completed and practically all of the rest are on or ahead of schedule, with only a few stragglers of any consequence, according to Joseph Tippets, director of Office of Air Navigation Facilities.

Based on previous CAA experience, it appears that the EIA committee will have a tough time convincing the agency to drop its liquidated damages clauses, particularly since there appears to be no lack of industry bids for CAA business.

Failing this, EIA will seek to set a maximum figure on damages—perhaps limiting them to total price of contract. Although CAA has no desire to invoke financial vengeance on a seriously delinquent contractor, there is some question whether it can legally set a maximum limit on damages. If the government suffers damages because of late delivery, there is no legal reason why damages suddenly cease when they



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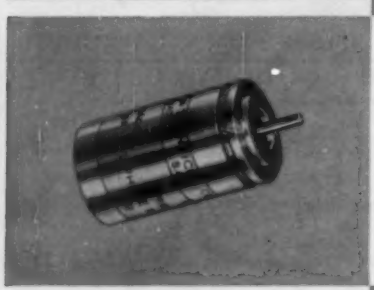

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equal the amount of the contract or other predetermined value.

Manufacturers who hope to be low bidders for CAA business must really sharpen their outlook and their pencils. Some of the toughest competition frequently comes from newcomers who have failed to read CAA specifications carefully enough, or who haven't heard about the thoroughness of CAA inspectors. For careless bidders, the price of getting an education can run high.

CAA is not bound to accept a low bid if the agency determines that a bidder is not qualified for the job. Before awarding contract to a newcomer, agency normally sends team to evaluate company's facilities, and personnel, according to Lewis Bayne, general services officer. But it is not always easy to draw the line between competence and incompetence.

Some manufacturers say that CAA should automatically suspect competence of any company that submits a bid which is far below that of known competent producers and/or former suppliers of the same item. This, they say, indicates lack of understanding of the job to be done.

One company cites the example of a recent CAA competition where the price submitted by the low-bidder, a newcomer, was considerably less than half the figure quoted by a company which had previously produced the device for CAA. Spokesman for the latter firm told AVIATION WEEK that cost of just his raw materials and tooling nearly equals price quoted by winning bidder.

Buying In

But sometimes a manufacturer intentionally underbids his estimated cost with the view to buying into a new field of future business. This can prove to be a short-sighted policy if another company bases its bid on the same idea in the next procurement.

There may be other extenuating circumstances. For example, when CAA questioned a company recently about its extremely low bid figure, company said it expected to suffer a loss, but wanted to keep its factory occupied so it could bid for forthcoming defense business upon which it hoped to make a profit.

Newcomers who wish to compare their own figures prior to bidding with the price paid by CAA to former producers of same or similar equipment can obtain such prices from the agency, upon request. But not too many companies do so.

Although CAA now has far more funds than in former years, it has a huge job to accomplish. The agency therefore is not unhappy when competition forces prices down, enabling it to stretch its budget.

For example, less than two years ago, CAA paid approximately $7,000 for a

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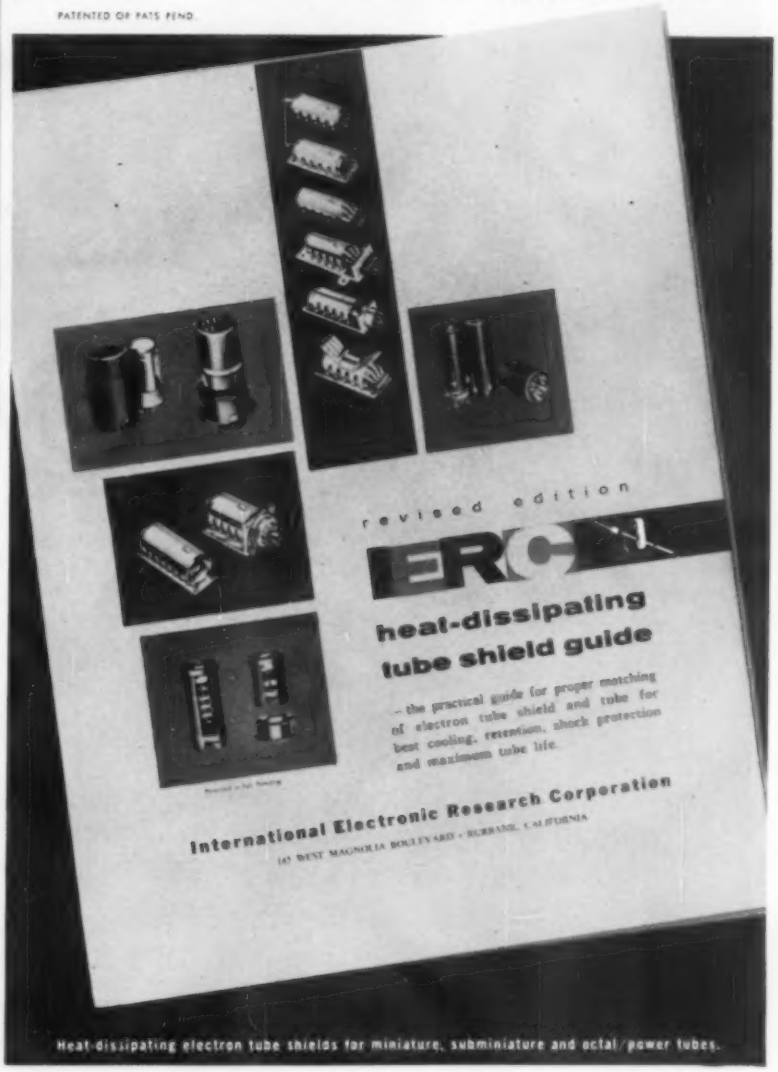
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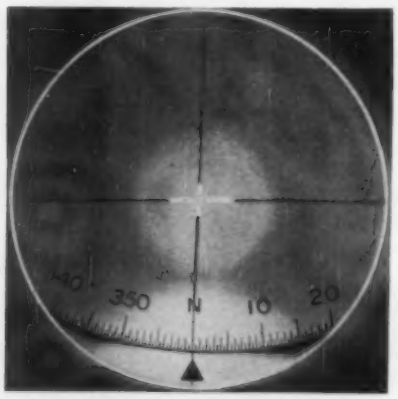
37½ kva. engine-driven generator used to provide power at remote sites. Last year the low bid for such generators had dropped to $5,200, and only last month the winning bid was only $4,200, according to Raymond Mulari, chief of procurement division.

Shelters for which the agency formerly paid $900, were bid at around $500 in a recent competition.

Critics say that CAA's procurement and inspection policies have soured many avionics manufacturers on doing business with the agency, forcing it to turn to new and inexperienced sources.

For example, these critics point to recent CAA procurement of ASR-4 airport surveillance radars. None of the three companies that built the earlier ASR-1, -2, and -3 sets (Gilfillan, General Electric, Bendix Radio) even submitted bids for the ASR-4. The winner, Texas Instruments, has never produced ground-based radar, although it has a fine record of producing airborne radars for the Defense Department.

All three of the previous ASR producers are believed to have lost money on their former contracts, and at least one is somewhat bitter about CAA inspectors. One inspector refused to accept company's moving target indicators (MTI) because he said the wiring was sloppy and insisted company re-wire unit for neater appearance, spokesman told AVIATION WEEK. Company says it warned inspector that MTI would not function properly if re-wired as he requested, but inspector was adamant. When re-wired units failed to function properly, company had to re-wire again in original configuration, but was not



Improved Sextant

Improved periscopic sextant developed by Kollsman projects azimuth scale into operator's field of view, permitting faster, more accurate celestial fixes. New Type A28450 pendulous-mirror periscopic sextant will be used by Pan American World Airways and Qantas on new jetliners. Kollsman also has increased brightness of artificial horizon reference to permit sextant's use against Venus during daylight hours.

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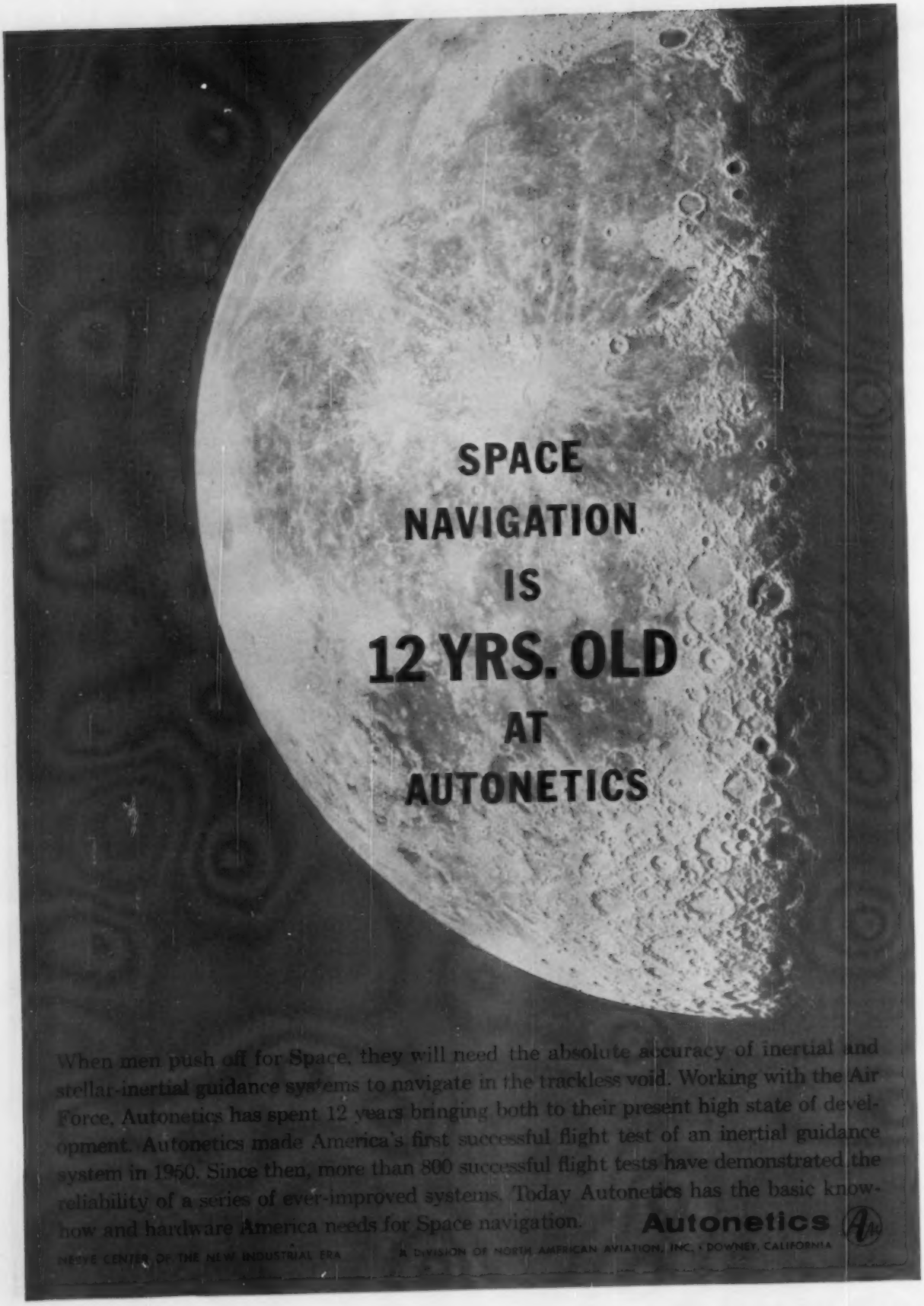
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Microwave Breakthrough

Chicago—Technological breakthrough in microwave tubes, which could greatly increase range of ballistic missile early warning radars and improve space communications, has been reported by Zenith Radio Corp. researchers. Tube, which operates on entirely new principles, has noise figure of 1 db., only fraction of that obtainable with other microwave tubes. Present models exhibit 30 db. gain, a bandwidth of 10% and appear suitable for use over frequency range of 100 mc. to several thousand mc.

reimbursed for the additional cost.

Another producer of navigation equipment for CAA reports that inspector forced it to disassemble equipment, repaint panels, when he decided the shade of gray was slightly off-hue.

CAA officials concede that some of agency's field inspectors may occasionally be over-zealous in seeking to protect the government's rights under a contract. Tippets admits that there are occasional misunderstandings on the interpretation of contract specs by field inspectors, but says that he receives far fewer squawks today than a few years ago. Agency officials say that contractors are encouraged to bring such problems to them without fear of reprisal.

In theory, CAA equipment procurement is let on a fixed price basis because they involve no development, only production. In practice, many programs involve considerable development, contractors say.

This development arises because CAA engineers seek to improve the accuracy and/or performance of new equipments over their predecessors. Calling for a 20% increase in accuracy of a VOR, for example, may be a laudable and justifiable objective, manufacturers concede. But a change of this nature, which appears insignificant, can actually require considerable development by the contractor. This frequently delays contractor delivery of the final articles, as well as increasing his costs.

Some contractors believe that CAA could alert bidders to changes from previous design by underlining such changes in its new specifications, or otherwise flagging them. This would be of some help, but obviously would not prevent an inexperienced firm from underestimating what is involved in achieving the improved performance.

Whether the risks and rigors of doing business with CAA are as severe as some critics suggest, the present surplus of avionics manufacturing capacity coupled with the amount of CAA procurement funds suggest that industry will adjust, much as it has to the problems of doing business with the Defense Department and unpredictable private consumer.

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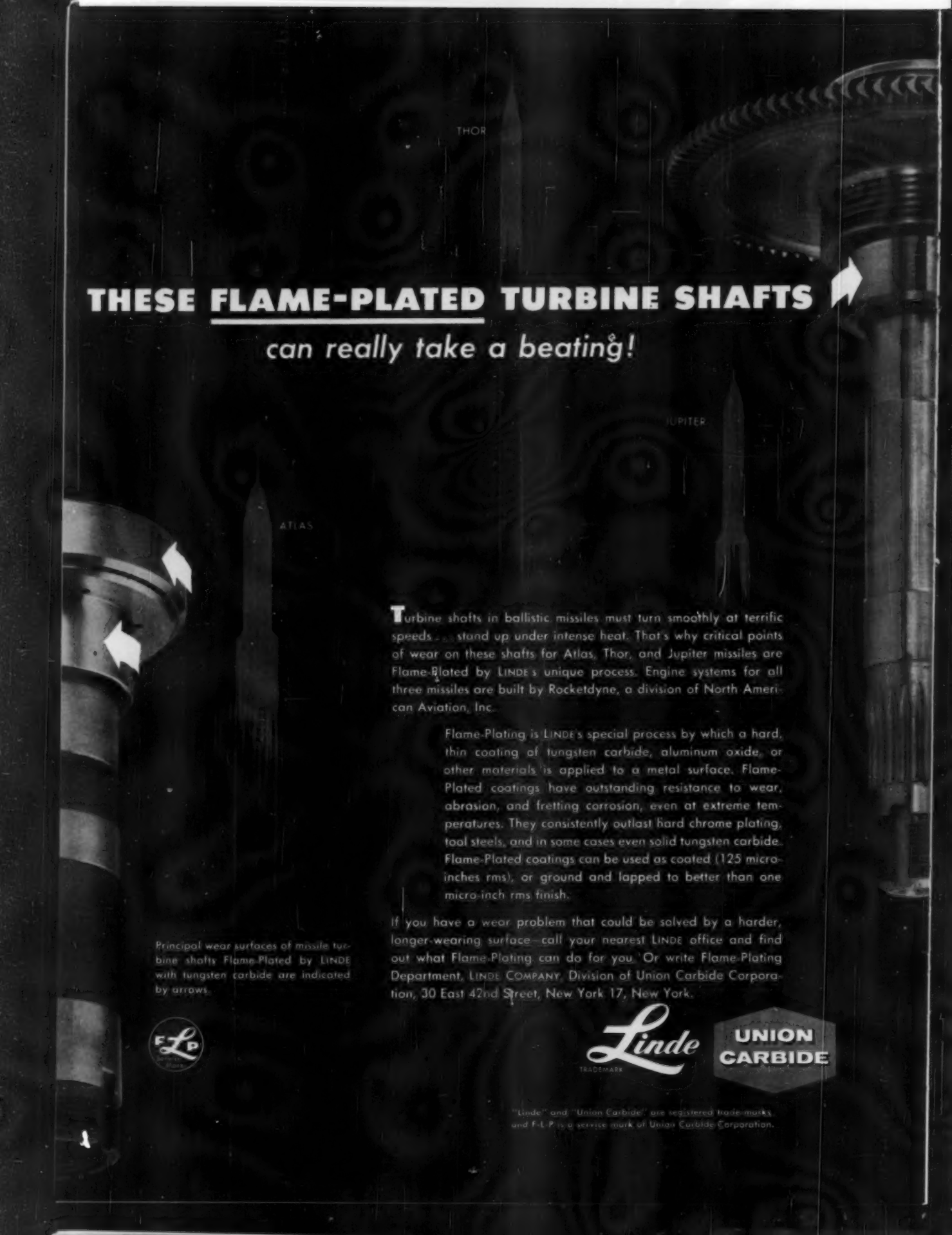

THESE FLAME-PLATED TURBINE SHAFTS

can really take a beating!

Turbine shafts in ballistic missiles must turn smoothly at terrific speeds . . . stand up under intense heat. That's why critical points of wear on these shafts for Atlas, Thor, and Jupiter missiles are Flame-Plated by LINDE's unique process. Engine systems for all three missiles are built by Rocketdyne, a division of North American Aviation, Inc.

Flame-Plating is LINDE's special process by which a hard, thin coating of tungsten carbide, aluminum oxide, or other materials is applied to a metal surface. Flame-Plated coatings have outstanding resistance to wear, abrasion, and fretting corrosion, even at extreme temperatures. They consistently outlast hard chrome plating, tool steels, and in some cases even solid tungsten carbide. Flame-Plated coatings can be used as coated (125 micro-inches rms), or ground and lapped to better than one micro-inch rms finish.

If you have a wear problem that could be solved by a harder, longer-wearing surface—call your nearest LINDE office and find out what Flame-Plating can do for you. Or write Flame-Plating Department, LINDE COMPANY, Division of Union Carbide Corporation, 30 East 42nd Street, New York 17, New York.

Principal wear surfaces of missile turbine shafts Flame-Plated by LINDE with tungsten carbide are indicated by arrows.

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WEATHER EYE infrared reconnaissance system is depicted mounted in a 20-in. Vanguard earth satellite. At an altitude of 300 mi. the one degree beams of the system would resolve an area of 6x6 mi. along the line of the orbit that degenerates to 10x10 mi. at a distance of 300 mi. to the left or right, and 50x50 mi. at the horizon. Detectors are mounted at 45 deg. angle from spin axis.

U.S. Designs Infrared-Scanner Satellite

By James A. Fusca

New York—Next U. S. satellite will be instrumented for infrared reconnaissance of the earth's cloud cover to gain meteorological information as part of the country's contribution to the International Geophysical Year. Successful orbiting of this vehicle will bring military reconnaissance satellites one step closer to reality.

Both of the next two Vanguard satellites to be launched will be 20 in., 21 lb. spherical vehicles equipped with a relatively simple infrared scanning system called "Weather Eye," designed for the Vanguard program by the Space Research Instrumentation Branch, Applied Physics Division, U. S. Army Signal Corps Laboratories.

Optical systems for two additional satellites have been delivered to the Jet Propulsion Laboratory by Perkin-Elmer Corp., Norwalk, Conn., which developed the optical systems for the Signal Corps. They will be used in the Army's Explorer satellite program. Next Explorer to be launched also will be instrumented for infrared reconnaissance.

System Operation

As designed by the Signal Corps, Weather Eye satellites will employ two infrared detectors to scan a path about 600 mi. wide in their flights around the earth in orbits that will fall between 35 deg. north and 35 deg. south latitude. Perigee will be about 200 mi. and apogee about 1,500 mi.

The infrared instrumentation has been kept relatively simple by the technique of using fix-mounted optics and spinning the satellite to obtain a scanning action. Satellite will spin at roughly one revolution per second, with the spin axis lying along the line of the orbit.

To be sure that at least one of the two detectors will be scanning the earth no matter where the satellite is in its elliptical orbit, they are mounted diagonally opposite and aimed at an angle of 45 deg. from the spin axis so that one optic scans 45 deg. ahead of the satellite and the other 45 deg. behind.

Beams of the two detector optical systems cover a solid angle of about one degree. Because they maintain a fixed angle relative to the spin axis,

information as to orientation of the spin axis can be obtained by measuring and comparing the lengths of pulses from the detectors as they sweep from horizon to horizon.

Primarily, what the detectors will see will be sunlight reflected from the earth and its cloud cover. Intensities of the light reflected from the different areas will differ appreciably: 80% from cloud areas, 15-20% from land areas, and 5% from the oceans. Therefore, signals from the detectors telemetered to the ground will paint out a picture of the earth below the satellite as it circles in its orbit.

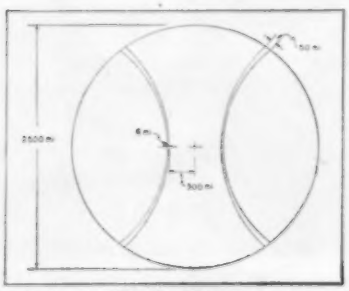
Significance of Results

Weather information obtained from these first reconnaissance satellites will be limited to observations of cloud masses, their distribution and motion. Significance of this information lies in the fact that clouds are the visible signs of the definite schemes of motion followed by the air and reflect the constantly changing conditions of temperature, pressure humidity and movement of the air at different levels above the earth's surface.

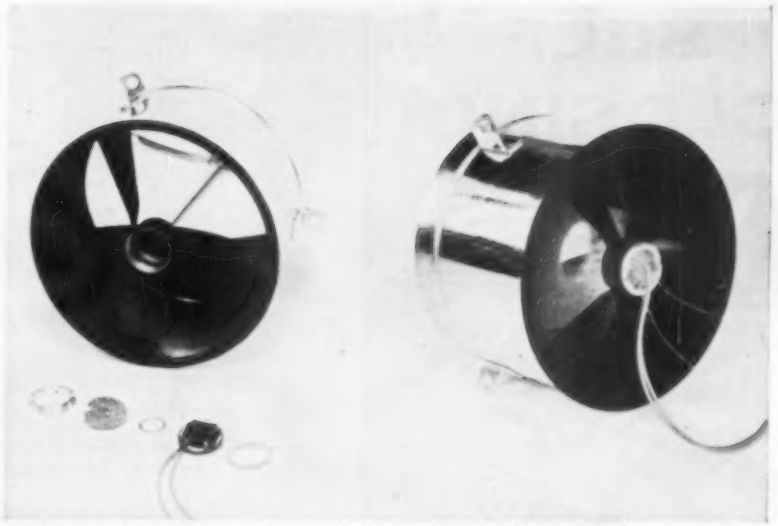
Data gained is expected to contribute significantly to scientific knowledge of the dynamics of weather. A simple but substantial gain will be in filling in gaps in cloud observations over uninhabited land and ocean areas of the world. At present, less than 5% of the earth's atmosphere is covered by meteorological observation.

Tracking of tropospheric weather systems by their clouds will make possible improved long and short range forecasts.

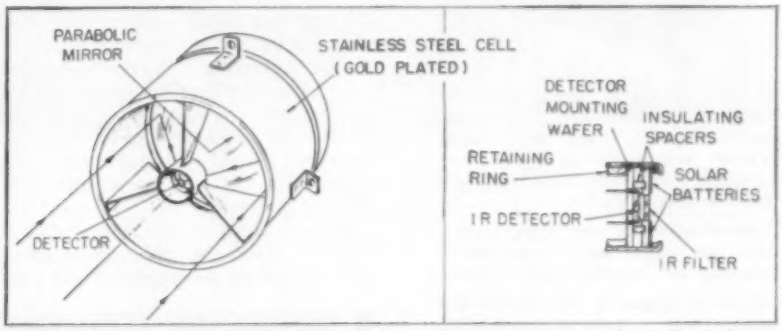
Later satellites with higher resolution reconnaissance equipment will make it possible to study the generation, growth and course of hurricanes and tornadoes. Investigations of the long term radiation balance will be correlated with climatic changes and the relationship between solar phenomena and tropospheric weather studied to learn the mechanism by which weather and climate are externally controlled.



AT 300 mi. altitude Weather Eye could scan 2,500 mi. but only data from 300 mi. lying to left and right of satellite path would be used. Beam path covers area of 6x6 mi. along line of orbit and 50x50 mi. at horizon.



OPTICAL systems are shown disassembled (left) and assembled (right). Mirror is mounted in 3-in. dia. can. Disassembled parts are (l. to r.): retaining ring, infrared detector mounted on wafer, spacer, holder for infrared filter and four solar batteries, and spacer.



DRAWING shows optical systems of Weather Eye equipment mechanically laid out.

Design of the weather instrumentation had to satisfy boundary conditions beyond environmental limitations such as size, weight, shape, spin and heat balance. Certain of the electronic parameters have been set up under the Vanguard project by the Minitrack radio tracking system.

These tracking stations have been laid out to create a "picket fence" reception effect so that a satellite comes within range of at least one station during each revolution around the earth. The satellite is within range of the station for approximately one minute during which it must be interrogated by a coded signal from the ground station and transmit to the ground data gathered and stored on tape during the last revolution.

Bandwidth available for the Weather Eye telemetry data is from 2.6 to 15 kc. Noise level of the ground receivers is defined as a 0.1 watt radiator at 2,000 mi., yielding a signal to noise ratio of one.

Two detectors of the Weather Eye system are lead sulfide, which means that they will be sensitive from the upper edge of the visible spectrum out to about three microns. Focusing energy on the detectors are two F/0.7 optic systems with 3 in. diameter apertures, weighing only 3.5 oz.

Tape Recorder

Signals from the two detectors amplitude modulate a 290 cps. subcarrier—because they have opposite polarity, one detector signal increases the subcarrier amplitude while the other decreases it. The composite signal is stored in a magnetic tape recorder that holds approximately 50 min. of data, about the amount of time it will take the satellite to pass over the sunlit side of the earth.

To conserve batteries and tape time the tape recorder will be turned off while the satellite is on the dark side of the earth. This is done by using a signal from four solar batteries mounted around the infrared detector to provide a bias signal for the recorder motor which causes the recorder to operate only when a reflected sunlight signal is present. Time constant of the system is sufficiently long so that the recorder

SELF CLOSING VALVES by LISLE

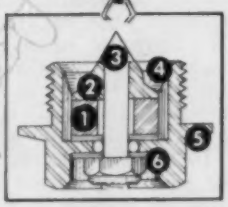
In any assembly using synthetic lubricant — particularly for aircraft applications — **Lisle Self-Closing Valves** are advantageous in conjunction with either Lisle Magnetic Plugs or Chip Detectors.

They eliminate oil loss during inspection and reduce fire hazards due to draining into cowling and airframe.

Illustrated above is the vertical-seal design with a Lisle Magnetic Chip Detector fully removed (top photo) and halfway installed (bottom).

Lisle Self-Closing Valves make it more convenient to service Magnetic Chip Detectors and Magnetic Plugs.

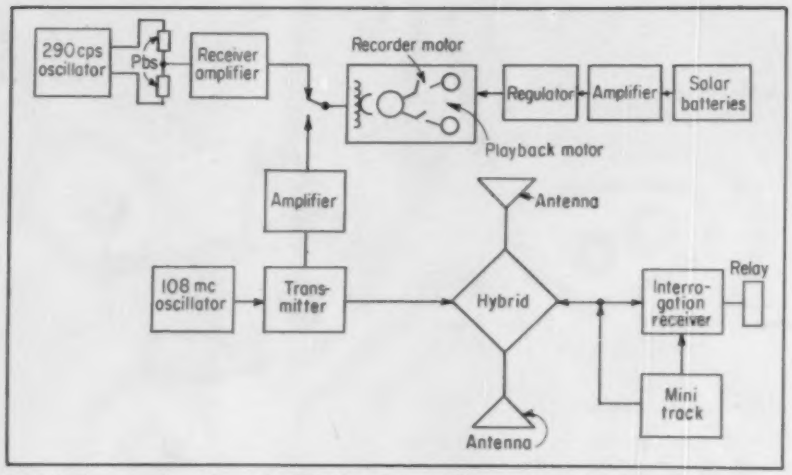
CHIP DETECTORS by LISLE



One of the many Lisle Magnetic Chip Detector Designs, showing
(1) Alnico Magnet
(2) Magnet Extension
(3) Non-Magnetic Terminal Shaft
(4) Insulating Tube
(5) Plug Body
(6) O Ring.

Write for Data and Low-Cost Test Samples of self-closing Valves or Chip Detectors.

LISLE CORPORATION
Clarinda, Iowa



BLOCK diagram shows how the Weather Eye satellite equipment is interrelated.

does not shut off as the detectors point away from the earth as the satellite spins.

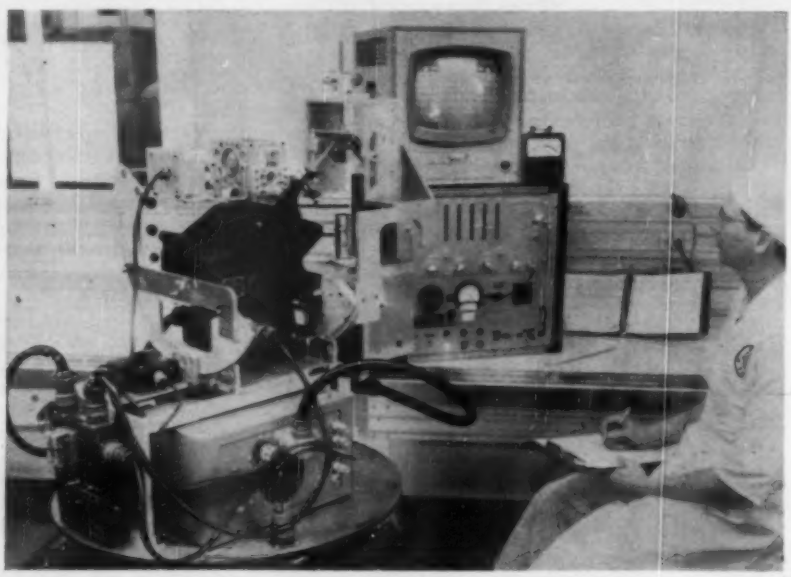
The recorder is conventional except for its very small size and light weight—2.5 lb. including batteries for two weeks of operation. It handles 75 ft. of one-quarter inch magnetic tape at a recording speed of 0.3 in. per second and playback speed of 15 ips. System switches to playback upon interrogation from the ground to provide the input signal for a one watt transmitter operating at 108 mc.

Data received on the ground and assembled from the different receiving stations will be demodulated and processed for presentation in analog form on an oscillographic type of display. Among the problems that must be allowed for in processing the data are position of the satellite in its orbit, spin axis orientation and solar angle.

Spin Axis Orientation

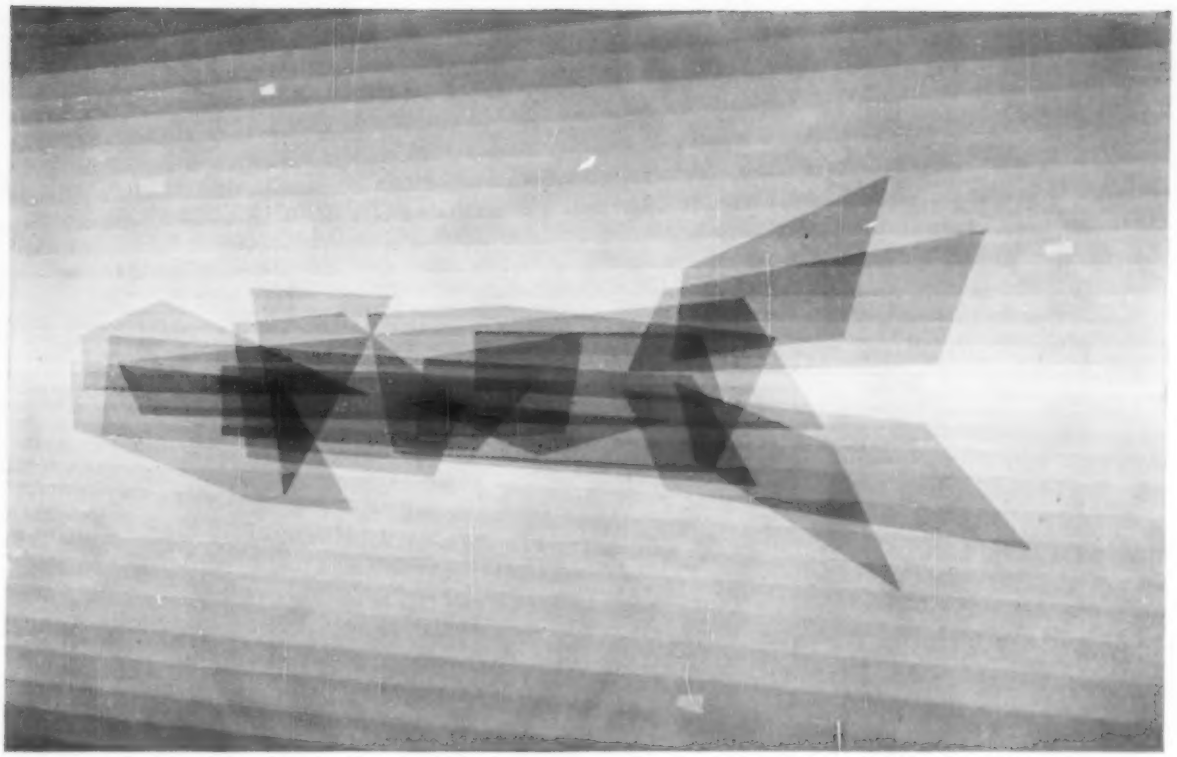
Importance of accurately determining orientation of the spin axis can be seen from the fact that knowing where the satellite is in its orbit, does not tell the observer where it is looking unless the spin axis orientation also is known.

This is because the orbit of the satellite is elliptical and its spin axis lies along the line of the orbit. There-



Gunsight Checked by Television

Closed circuit TV is used to check alignment of computing gunsight for Republic F-105 while sight is mounted on rate table. Gunsight is part of XMA-8 fire control system, which includes toss-bombing computer, produced by General Electric Co.'s Light Military Electronic Equipment Dept. The company also is providing automatic flight control system for airplane under a $4.6 million contract.



"ROCKETS", one of a series of paintings by Simpson-Middleman, a team of artists with the rare ability to translate scientific fact into creative imagery. Here, the rocket's blast and its guiding beam are thought of as a single stream of light through the center. Darks and lights of definite shape in a weak visual vector field are relied on to suggest the dynamics caused by the acts of the servo-mechanisms in making their adjustments. Painting courtesy John Heller Gallery, Inc.

man in space

Boeing has planned ahead to meet the problems and develop the potentials of the space age—through organizational structure, expanded facilities and advanced fundamental research.

The Boeing Systems Management Office develops proposals and provides management for all projects employing space-age techniques. Advanced studies include boost-glide vehicles, anti-ballistic missile area defense systems, air-to-surface missiles, and manned and unmanned space vehicles.

Boeing's space-age orientation, its tremendous technical and research capability, and its outstanding weapon system management experience earned for the company and its associates an Air Force assignment for Phase I development of Dyna-Soar. This is a weapon system based on a manned boost-glide vehicle that will orbit at speeds approaching 18,000 miles an hour, and be capable of re-entering the atmosphere and making a normal landing.

Dyna-Soar and other space-age projects at Boeing offer exceptional opportunities to engineers of all categories, and to physicists, mathematicians and scientists. Drop a note now to Mr. Stanley M. Little, Dept. C-78, Boeing Airplane Co., Seattle 24, Wash.

BOEING

fore, the spin axis will be horizontal (normal) with the respect to the earth's surface only at apogee and perigee.

Information as to the spin axis orientation is obtained by comparing the lengths of the pulses from each detector as they sweep across the earth from horizon to horizon, the length of the pulse indicating the amount of time that the detector was actually viewing the earth. But, because the orbit is elliptical, there will be periods during which only one detector will be seeing the earth. At these times, it will be necessary to compute the orientation on the basis of previously transmitted data.

The arrangement of the two detectors will keep at least one of them viewing the earth as the satellite spins despite the elliptical orbit as long as it stays within 1,700 mi. of the planet.

The one degree beamwidth of the optical systems will resolve a 6 mi. by 6 mi. area presuming optimum conditions and the satellite at 300 mi. altitude with the spin axis lying normal to the earth. As the angles of viewing and the altitudes change, this will deteriorate until an arbitrarily set upper limit of 30 mi. by 30 mi. is reached. In any case, however, only that data coming from the 300 mi. lying to the left and right of the satellite path will be used—generating a 600 mi. wide infrared strip map of the sunlit side of the earth with each revolution.

FILTER CENTER

▶ **Arma Eyes Other Mergers**—American Bosch Arma Corp. is expected to extend its capability in the radio frequency end of the spectrum through acquisition of other avionic companies, regardless of outcome of present merger talks with Northrop Aircraft Co. Likely candidates reportedly include Allen B. DuMont Laboratories and Hazeltine.

▶ **Minuteman Guidance**—North American's Autonetics Division, which won recent competition for development of inertial guidance system for USAF's new Minuteman intercontinental ballistic missile, has not yet decided whether to use its own digital computer or one developed by another company. AVIATION WEEK (June 30, p. 15) had reported that North American originally proposed to use computer developed by Librascope.

▶ **RAMAC, Can You Spare a Part**—Boeing Airplane Co. says it is first aircraft company to install new International Business Machines Corp. RAMAC (Random Access Method of Accounting and Control) which will be used to speed spare parts service to jet-

Management Executives—

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Please . . . no employment applications. We are deluged with resumés from engineers, tool makers, technicians, Ph.D.'s, etc., and cannot possibly aid in placement requests as we already have a tremendous surplus of skilled and professional labor here now. Sorry.

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A reliable, easy-to-use microscope for precise measurement of piece parts, tools, dies, thread gages, templates, jigs, fixtures, etc. You make direct, non-destructive measurements — no contact, no distortion, images are sharp and clear.

Used by U. S. Govt. Gage Laboratories, and by prime contractors and their subcontractors. Use of the same measuring instrument by all parties co-ordinates inspection procedures, and minimizes disagreements and rejects.

Write for Bulletin 147-56

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liner customers. RAMAC can store up to five million digits on stack of 50 metal disks in a "juke-box" arrangement, provide random access to any stored information in seconds.

▶ **No Interference, Please**—Growing problems of electromagnetic interference in military electronic equipment will be covered at Army-sponsored conference on Radio Interference Reduction and Electronic Compatibility, Oct. 1-2, at Museum of Science and Industry, Chicago. Conference will be conducted by Armour Research Foundation of Illinois Institute of Technology. Institute of Radio Engineers' professional group on radio frequency interference will cooperate in the program.

▶ **Moon Relay Tests**—Radio-teletype signals at frequency of 810 mc. were recently transmitted between Cedar Rapids, Iowa, and Army Electronic Proving Ground, Ft. Hauchuca, Ariz., by bouncing signals off the moon, Collins Radio Co. has disclosed. Signals traveled approximately 500,000 mi. in approximately 2½ sec. Company says tests "probably" were first time that moon has served as relay for communications in the 1,000 mc. band.

▶ **Signed on Dotted Line**—Major avionic contract awards include:

• **Telecomputing Corp.,** Whittaker Gyro Division, Van Nuys, Calif., $1.8 million, from Western Electric, rate and position gyros for use in Nike Hercules anti-aircraft missile.

• **Ampex Corp.,** Redwood City, Calif., $1.2 million from Navy Bureau of Aeronautics, for airborne magnetic recorders.

• **Eitel-McCullough,** San Bruno, Calif., $1.3 million from Sperry Gyroscope Co., for production of ceramic-metal traveling wave tube.

• **Altec Lansing Corp.,** Anaheim, Calif., $350,000 from Douglas Aircraft Co., for ground communications systems to be used at Thor missile launching sites. System features special command override circuit which enables ranking officers to automatically cut off any other voice using system at the time.

• **Westinghouse Electric,** Electronic Tube Division, Elmira, N. Y., $270,000 contract from Navy Bureau of Ships, for magnetrons capable of generating 10 million watt radar pulses.

• **Western Electric,** $3.7 million from Navy Bureau of Ordnance, for weapon direction equipment to be used in tracking targets, evaluating threats and assigning Terrier missile batteries.

• **Westinghouse Electric,** Air Arm Division, undisclosed size contract from Boeing Airplane Co., for "greatly advanced" airborne terminal guidance system to be used in Bomarc-B, long-range air defense missile.

MICRO-BEARING ABSTRACTS

by **A. N. DANIELS,** *President*
New Hampshire Ball Bearings, Inc.

DYNAMIC AND STATIC LOAD RATINGS

Load ratings of MICRO bearings are based on standards established by the Anti-Friction Bearing Manufacturers Association and are the result of extensive tests.

The "life" of an individual bearing is defined as the number of revolutions the bearing makes before the first evidence of fatigue develops. Fatigue, in turn, is a function of bearing load and although other factors, such as contamination and high temperature, affect the life of a bearing, it is assumed that clean bearings running at normal temperatures are being considered.

It is not possible to predict the life of any individual bearing. The problem, therefore, is best approached by a consideration of empirically derived dispersion curves which provide a means of determining bearing life on a probability basis. That is, they permit the average life of a given group of bearings to be accurately specified.

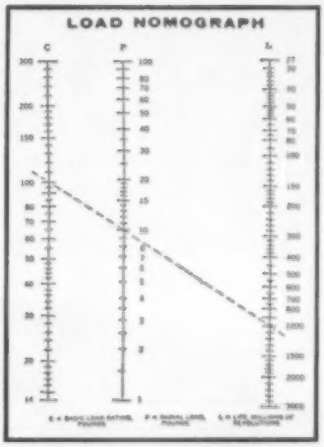
For purposes of standardization, the "rating life" of a group of apparently identical ball bearings is defined as the number of revolutions that 90% of the group will complete or exceed before the first evidence of fatigue develops. This figure is approximately one-fifth of the average life.

If two groups of similar bearings are run under different loads F_1 and F_2 within normal operating range of loading and rpm, their lives L_1 and L_2 are inversely proportional to the cubes of the loads, i.e., The BASIC LOAD RATING C is that radial load which a group of apparently identical bearings can endure for a rating life of one million revolutions, with stationary load and rotating inner ring. Within normal operating ranges, rating life for any load is a constant number of revolutions, so the following relationship, a restatement of the inverse cube proportion, may be used to compute rating life when basic load rating and applied radial load are known:

$$L = \left(\frac{C}{P}\right)^3$$

L=rating life in millions of revolutions
where, C=basic load rating in pounds
P=applied radial load in pounds

The nomograph illustrated permits the quick evaluation of any one of the three quantities when the other two are known. For example, if the C rating of a given bearing is 95 pounds, and the bearing is loaded radially with



12 pounds, P, a straight edge crossing these two values in their respective columns shows that the bearing could be expected to have a life, L, of 450 million revolutions.

"EQUIVALENT LOAD"

Bearings whose loads are primarily radial are usually also subjected to axial forces. When the axial component of the load is greater than a negligible value, this combined radial and thrust load may be expressed in terms of a simple radial load in order that the basic load rating C may be calculated. This simple radial load is known as the "equivalent load", which is that constant stationary radial load which, if applied to a rotating inner ring, would give the same life as that which the bearing will attain under the actual conditions of load and rotation.

A formula for determining "equivalent load" and a more comprehensive discussion of static and dynamic loads is found in our design handbook.

DESIGN HANDBOOK OFFERED *FREE*

You'll find this new, 70-page authoritative publication a great help in solving problems in designing instruments or small electro-mechanical assemblies.

Write to: New Hampshire Ball Bearings, Inc., Peterborough 1, N.H.

Typical cut-away views of instrument-type retainer ball bearings.

NEW HAMPSHIRE BALL BEARINGS, INC., PETERBOROUGH 1, NEW HAMPSHIRE

PLANE FAX

by STANDARD OIL COMPANY OF CALIFORNIA

4000 feet straight down—with a ton of steel

Not a disaster — just one of almost 200 regular flights made by E. M. "Buzz" Westcott to the bottom of the Grand Canyon. Taking off from Kingman, Arizona, where he operates the Kingman Flying Service, he's ferried steel girders, motors, cables, supplies and construction crews to a tiny sand strip 4000 feet below the canyon rim.

"They're building a tramline to haul guano to the top of the rim, and I've had to fly in everything they need," says Mr. Westcott. "My old Travelaire is just the ticket for this kind of heavy hauling — as long as I have Chevron Aviation Gas in the tank. Even on broiling hot days its P&W 450 puts out full power on Chevron with never a miss. Chevron never fouls plugs, either — I know it'll get me where I'm going, and get me back.

"Of course, I take care of my engines. I overhaul at 1000 hours for safety's sake, but I always find RPM Aviation Oil has kept the engines near-perfect right up to the teardown. 'RPM' holds engine compression at factory standards, keeps parts clean and free — I never have trouble with sticking rings or pre-ignition."

TIP OF THE MONTH

Bright-colored jackets and shirts sometimes cause reflections in the windshield, can cut night visibility. It's smart to wear dark clothes on night flights.

We take better care of your plane

CHEVRON AVIATION GASOLINE

AVIATION OILS RPM

T.M'S "RPM," "CHEVRON," "PLANE FAX," REG. U. S. PAT. OFF.

AIRCOUPE, with no rudder pedals, can be landed in crabbed attitude in crosswind. There are no flaps. Wing area is 142.6 sq. ft.

Neat and rugged airplane is of all-metal construction, with flush riveting on airflow surfaces. Demonstrator had Day-Glo markings on prop hub, tips and outside panel of vertical stabilizers. All production models will have similar blaze orange high-visibility markings unless otherwise specified by the customer. There is no additional cost involved.

Airplane sits close to the ground on its tricycle gear, height to nose being but 5 ft. 6 in., making for easy access to engine. Gear tread is 8 ft. Oil capacity can be checked via flush-mounted cowling access door, without opening cowling.

Cockpit was entered via walk-on surface on wing. With two aboard, seating was roomy and comfortable. One-piece foam rubber seat is solid cushion, like auto seat. Lack of rudder pedals negates need for fore and aft movement. Leg room is plentiful, only the floor brake pedal being on pilot's side.

Centerpiece canopy is composed of three rolling panels, one of which is filtered to shade the sun. Two sections alone form the complete centerpiece. The filtered section can be adjusted to convenience of pilots.

Dual control wheels are standard on this airplane. Engine instruments are mounted to left of panel, flight instruments center. Throttle quadrant is located bottom, center, of main panel and seats throttle knob and trim knob. Radio equipment included Narco Simplexer VC-27, Omniplexer VOA-2 and LFR-3.

Baggage compartment is located in cockpit, just aft of seat, and holds 75 lb. It will also take a "kiddie seat" for a child up to the same weight, in lieu of luggage. Overlooking the luggage compartment is large hat shelf and cabin speaker. Master switch is inconveniently located on top of hat shelf; Forney may relocate this switch forward of pilot on instrument panel.

Each wing tank holds 9 gal. of fuel; the nose fuselage tank holds 6 gal. Fuel is pumped from wings to nose tank, where it is gravity fed to engine. Cockpit fuel gage, recessed in low side of fuselage to left of pilot, shows capacity of wing tanks only. Nose tank incorporates float-type gage on top of cowling. Indicator, at maximum extension, shows 1 hr. supply, good safety margin in event of fuel pump failure which would affect wing tanks.

Wing tank shut-off valve is located under and forward of instrument panel, on right side of fuselage, and does not affect flow from nose tank. In similar position, forward of pilot's seat, is fuel shut-off valve which restricts supply from all tanks.

Engine started quickly and airplane was taxied out for run-up. Taxiing was smooth, and Aircoupe swiveled easily as control wheel was turned left or right.

Demonstrator flown was N7518C. Dry weight, with instrumentation, was 912 lb. With two aboard, plus 130 lb. of gas and oil and 60 lb. of luggage, airplane grossed over 1,500 lb. Sea level pressure was 29.67 in. (1005.1 mb.). Wind was from the west at 18 kt. Outside air temperature was 62F.

Before taking the runway I had to cross my legs to avoid reaching for rudder pedals that wouldn't be there. We had a 45 deg. crosswind, and deliberately ran first takeoff long. With full throttle, airplane was steered down runway like a car. Weathercocking was easily offset by steering. Upwind wing came up some, but airplane, because of negative wing angle, was still holding ground at 70 mph. until wheel was pulled back sharply and airplane yanked off, after about 700 ft.

Initial climb was made at 80 mph. Nose was lowered slightly for better forward visibility, and at 90 mph. Aircoupe went up at 600 fpm.

Airplane was leveled off at 4,000 ft. and mixture slightly leaned out. At this

Aircoupe F-1

Specifications

Empty weight	890 lb.
Gross weight	1,400 lb
Useful load	510 lb.
Wing span	30 ft.
Wing area	142.6 sq. ft.
Length	20 ft. 2 in.
Height (nose)	5 ft. 6 in.
Height (tail)	6 ft. 3 in.
Power loading	15.5 lb./hp.
Wing loading	9.82 lb./sq. ft.
Baggage capacity	75 lb.
Fuel capacity	24 gal.

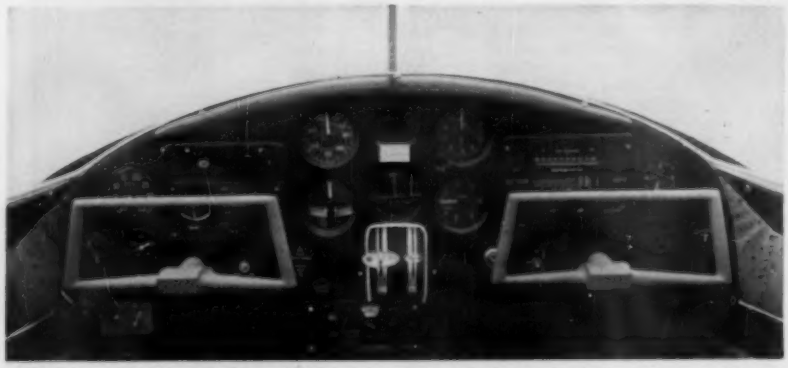
Performance

Range	500 mi.
Fuel consumption (75% power)	5.6 gph.
Absolute ceiling	18,000 ft.
Service ceiling	16,000 ft.
Max. cruise (75% power)	121 mph. TAS
Stall speed	56 mph. TIAS
Takeoff distance (sea level)	500 ft.
Landing roll (sea level)	600 ft.

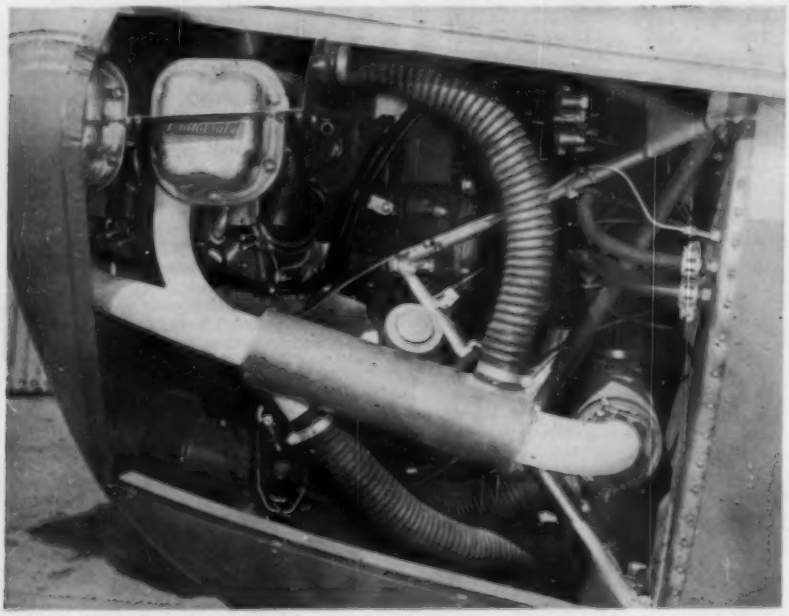
Aviation Week Pilot Report

Latest Aircoupe Embraces 258 Changes

POSITIVE stick action gets Aircoupe airborne. Note large windshield-canopy area.



COCKPIT and instrumentation of Aircoupe. Dual controls are standard equipment. Wheel coordinates ailerons, elevator and rudder, plus ground steering.



CONTINENTAL engine is easily accessible from ground, will soon be rated at 100 hp.

By Robert I. Stanfield

New York—Forney Aircraft's all-metal, spin-proof Aircoupe F-1 embraces some 258 modifications over its predecessor, the Ercoupe, of which several thousand were built in Maryland by Engineering Research Corp., acquired by Forney in 1955.

Major among these are new nose and bottom cowl, heavier gage all-metal wing, beefed up gear incorporating Belleville springs, plus interior with seat stressed for 12Gs, bubble-type tinted windshield with sun-filtered overhead canopy.

Model F-1 is produced at Forney's Ft. Collins, Colo., plant. Aircoupe features single control wheel, which alone coordinates ailerons, rudder and elevator, plus ground steering. Sole floor pedal activates brake. Castered gear takes the crosswind factor out of take-offs and landings.

For the beginner the transition to flight without rudder pedals should be quick and simple.

Performance factors evidenced during flight evaluation by AVIATION WEEK embraced:

• **Takeoffs and landings.** Wind is no problem. Airplane was crabbed into cross-wind of 15 kt. on approach. Ground contact was made in crabbed position. Nose wheel immediately swiveled around to carry airplane straight down runway. During cross-wind takeoff wheel alone held airplane in line. There are no flaps.

• **Flight coordination.** Aircoupe was held in gentle and steep turns at varying rates of speed. In turns only the inboard rudder is activated. Control forces were light, and the ball remained centered throughout attitude changes.

• **Safety in flight.** Aircoupe has no tendency to spin, and a stall just brings on an increased rate of sink. At 75% power—2,300 rpm.—the airplane was pulled nose high until airspeed indicated 40 mph., then placed in 90 deg. bank. There was no loss of altitude, no falling out. Power off, with airspeed indicating 45 mph., there was no heavy buffet, rather a nose-high mushing down at 500 ft. per min.

Light, two-place Aircoupe is powered by a Continental C-90-12F engine generating 95 hp. at 2,625 rpm. at take-off. Same engine soon will be rated 100 hp. Propeller is metal McCauley 1B90CM71-52, fixed pitch. Dry weight of airplane is but 890 lb., gross is 1,400 lb. Useful load is 510 lb. Seating is side-by-side.

altitude, pulling 75% power—2,300 rpm.—airspeed indicated 115 mph. on heavily loaded airplane, for true air speed of 123 mph. Outside air temperature was 49F. Airspeed is red-lined at 145 mph.

Cross-country flight was of 2 hr. 40 min. duration. Fuel consumption averaged 5.5 gph. Flight was comfortable and we didn't have to raise our voices to converse. With big windshield area and bubble-type canopy, visibility was excellent. One can look directly behind in this airplane.

Flight Characteristics

Aircoupe is quite maneuverable and stable, with no unfavorable characteristics apparent throughout unusual flight attitudes and low speeds. Stalls produce little buffet and no break; rather a nose-high sink which can be adjusted with addition of power.

With engine turning 1,500 rpm., Aircoupe was flown at 55 mph. during bank and turns. Control and aileron-rudder coordination were excellent; wheel alone does the trick very nicely. In extreme nose-high attitude, power off, airplane did buffet some and sink rate increased to 1,000 fpm. Holding 45 mph. there was no buffet, just a steady sink at 500 fpm.

It wasn't until several landings were made that I began to feel at home without rudder pedals. Because of gusty wind, approach was made at 80 mph. indicated airspeed and rpm. at 1,500. Rate of descent was 500 fpm. (Normal approach varies from 60-70 mph.)

With crosswind, airplane was crabbed on approach and landed in this attitude. Here was where I missed the rudder pedals. But in every instance touchdown was made at about 55 mph. in crabbed position, airplane's nosewheel swinging around on contact to take Aircoupe straight down the runway.

Normal takeoff got us off the ground in less than 500 ft. in about 17 sec., again with decisive pull of wheel. Airplane can get in and out of tight spots, but it won't fly itself off; a little yank, after reaching flying speed, will do the trick.

Short-field takeoff was made by holding wheel back at start of roll. In this manner airplane was flown off at 50 mph., in slightly over 300 ft. Holding 70 mph. on approach and 60 mph. over the fence, Aircoupe was landed and stopped in less than 200 ft.

Businessmen Market

Checking out in the Aircoupe can be a quick process, and Forney is aiming the airplane at the businessman who wants to learn to fly in a hurry. Company delivered 58 Aircoupes by July 1 and expects to produce a total of between 180 and 200 this year. Deliveries to date have been contingent on availability of engines.

Basic price of the airplane is $6,995. Standard equipment includes dual controls, airspeed indicator, sensitive altimeter, tachometer, rate of climb, turn and bank, oil pressure and temperature gages, navigation and instrument lights, illuminated compass, tinted overhead sun shade, air vents, cabin heater, tinted windshield, foam rubber seat, tie-down rings.

Most aircraft fly away with $800-900 worth of optional equipment, mainly radio-navigational. Optional equipment offered includes "kiddie" seat, wing landing lights, artificial horizon, directional gyro, gages for manifold pressure, cylinder head temperature and outside air temperature, clock, anti-collision light, navigation light flasher, cabin speaker, and Narco VC-27 Simplexer, VOA-2 Omniplexer and Superhomer.

Forney estimates direct hourly operating cost to be $3.14, based on following:

- **Gas and oil**—5.6 gph. at 35¢ per gal. and oil at 40¢ per qt., including 25-hr. oil change—$2.12.
- **Inspection and maintenance**—25 and 100 hr. inspection, parts and normal maintenance—52¢.
- **Reserve for engine** overhaul—approximate rate of $500 at manufacturer's recommended 1,000 hr. interval—50¢.

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Stainless steel brazed honeycomb "sandwich" structures are solving critical thermal, dimensional and strength-weight ratio problems in the latest air weapons systems.

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Expansion of our operations has created openings for additional qualified senior engineers. For information, write to Mr. L. C. Wolfe, Chief Engineer.

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Three YH-40s are in progressive construction stages on Bell final assembly line. Six will be delivered to Army.

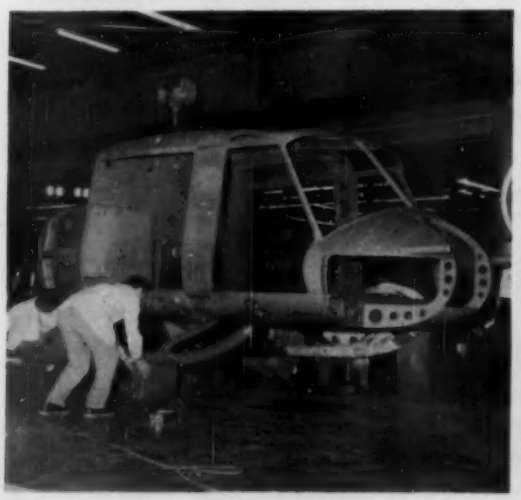
Bell HU-1 turbine helicopter will come off production line this fall and will be the company's entry in the commercial turbine helicopter sales market. Army YH-40, a service test version, has been used for Civil Aeronautics Administration familiarization demonstrations (AW Aug. 4, p. 95). Commercial version, designated Model 204, carries six persons, has a ferry range of more than 600 mi. and cruise speed of 115 mph. Bell is not yet ready to take commercial orders although CAA certification is first step toward this market. Harvey Gaylord, Bell president, said the Model 204 will be made available for commercial delivery as soon as military production permits. Helicopter is powered by Lycoming T53 gas turbine engine which, on the YH-40, has been derated to 770 shp. The engine is currently undergoing CAA certification tests at Stratford, Conn.

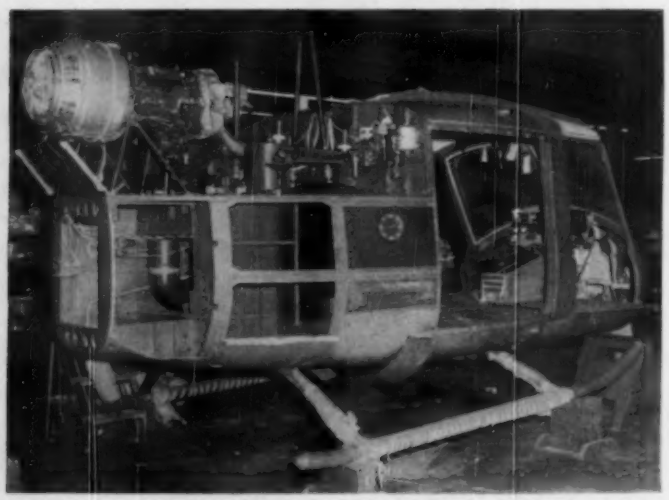
Turbine engine is rated at 860 shp., has been derated to 770 shp. on YH-40 model.

T53 engine and Plexiglas windows are installed in this YH-40. Inlets on top of cabin are for cabin air; nose contains UHF and VHF antennas.

Army YH-40 maneuvers during CAA familiarization demonstration by Bell Helicopter Corp. as first step toward entry into commercial turbine helicopter market. Engine air inlet ducts have been changed from XU-40 configuration and cabin has been lengthened.

Civil Market Seen for Bell Turbine Helicopter





Overhead crane carries YH-40 cabin assembly (left) to start of final assembly line. Workman (right) adjusts engine section wiring.

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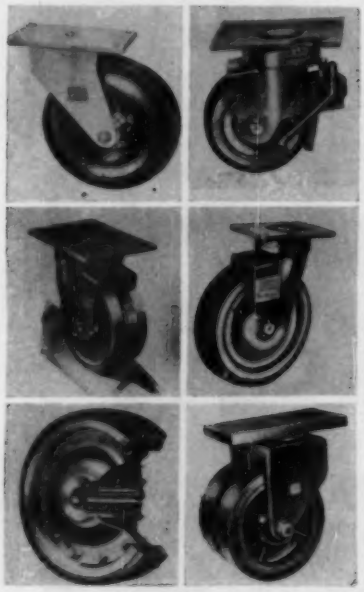

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French Start New Helicopter Services

Paris—Two private companies have started limited commercial helicopter operations in France. Normandy Autobus Co.—a surface bus transportation firm—is operating a Vertol V-44 between Caen and Le Havre, making three flights daily with stops at Norman beach resorts. V-44 has been leased from Heicop-Air, Vertol's representative in France.

In the Paris area, Air-Inter is flying a taxi service between Orly and Le Bourget Airports using a Sud Aviation Alouette turbine-powered helicopter on an unscheduled basis. Trip between the two fields costs $11.

PRIVATE LINES

Six Kawasaki-built Bell 47 helicopters will be shipped to Burma under a $550,000 reparations contract, with Burmese bearing cost of Japanese-imported engines and other equipment, not falling under reparations agreement. Deliveries are contracted to begin in September.

Delivery of a Convair 240 executive transport to Hal Roach Studios marks initial transaction under new long-term lease and lease-purchase program developed by William C. Wold, New York aircraft broker. Plan provides for Wold to handle sale of customer's current equipment and credit all or portion of this to lease of new aircraft. Contract with Hal Roach calls for five-year lease and added five-year extension.

Transland Ag-2 agricultural plane received Type Certificate 4820 from Civil Aeronautics Administration. Plane is powered by a 600 hp. Pratt & Whitney R1340 engine and is designed to carry 2,000 lb. of low-density solids or 3,000 lb. of higher specific gravity chemicals in its 53-cu.-ft. hopper. Production of Ag-2 is planned in single and two place versions with open and closed cockpit.

Fairchild F-27 completed 50-hr. accelerated flight test program for CAA in five days despite poor weather during period. Routes flown simulated local service flights, and a nonstop flight was made from Hagerstown, Md., to New Orleans, La.

Order for some 30 Japanese-built Fuji LM-1 trainers, Beech T-34 Mentor under license, is expected to be placed by Indonesia, with contract expected to provide for 10-yr. installment plan purchase.

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Please write to: Mr. A. H. Stevenson, Engineering Personnel, North American Aviation, Los Angeles 45, California.

THE LOS ANGELES DIVISION OF
NORTH AMERICAN AVIATION, INC.

Light De-Icer

Inflated boots of new Goodrich lightweight de-icing system for small twin business planes is examined on tail of Piper Apache by Joseph Yowell, president, Westport Development & Manufacturing Co., Conn., which installed prototype system on its own airplane. Similar boots cover entire leading edges of wings. System weighs only 50 lb. installed, utilizes air compressed in ½-cu.-ft. Fiberglas sphere to activate boots (AW June 23, p. 75). Sufficient compressed air can be carried to provide up to six hours of de-icing if boots are activated every three minutes.

USAF Contracts

Following is a list of unclassified contracts for $25,000 and over as released by U. S. Air Force contracting offices:

HEADQUARTERS, AFMTC, ARDC, USAF, Patrick AFB, Fla.

General Dynamics Corp., San Diego, Calif., design and fabrication of reference wave guide system and other spare parts for Azusa Mark I, (PR-58-1248, contr. AF 08(606)-2740), $186,650.

Photo-Sonics, Inc., Burbank, Calif., 70 MM motion picture cameras and accessories, (PR-58-1177, contr. AF 08(606-2758), $85,000.

Western Military Electronics Center Division, Motorola, Inc., Phoenix, Ariz., Model I C-band beacons, (PR-58-1326, contr. AF 08(606)-2790), $424,110.

Nems-Clarke Co. Division, Vitro Corp. of America, Silver Spring, Md., design, development and fabrication of airborne RF preamplifiers and multicouplers, (PR-58-1375, contr. AF 08(606)-2795), $32,765.

John C. Abbott, Vero Beach, Fla., service and materials for the construction of dual CZR camera pad, (U64R205), (IFB 08-606-58-243), $34,369.

Nems-Clarke Division, Vitro Corp. of America, Silver Spring, Md., airborne telemetry receiver racks, four ea., AFMTC TIM-27-C, (PR-58-1379, contr. AF 08(606)-2797), $53,892.

Dynatronics, Inc., Orlando, Fla., elevated balloon telemetry antenna system, TIM-44, (PR-58-1358, contr. AF 08(606)-2824), $75,-835.

Producers Sales Corp., Burbank, Calif., printer, optical, motion picture supplies, (PR-58-1315, contr. AF 08(606)-2777), $34,-995.

Convair Astronautics Division, General Dynamics Corp., San Diego, Calif., "B-2" service-test transponders and ancillary equipment and data, 55 ea., (PR-58-1394, SA-4 to letter contract AF 08(606)-2400), $300,000.

Milgo Electronics Corp., Miami, Fla., modi-

Mr. Edmund Converse, President, Bonanza Air Lines

TECO Coronado 600 airline seats are the Bonanza 'Silver Dart' fleet's best bet—all ways!"

Bonanza Airlines' decision is similar to other major airline systems here and abroad. TECO's Coronado 600 series airline seats were required to pass stringent examination and evaluations by Bonanza's experts in the same manner as all other equipment items phased into their new F-27 'Silver Dart' fleet!

The TECO Coronado 600 was selected for outstanding comfort, styling, light weight and low maintenance features—all in a neat, low-cost unit, available to meet Bonanza's delivery schedules.

The story doesn't end here though — not if *your* airline wants these same 'exclusively TECO' benefits! Write for free TECO Coronado 600 airline seat information and the latest on TECO's *production-available* Energy Absorption—for the 600 series, too!

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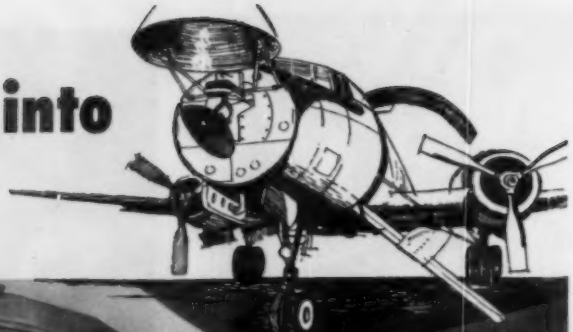

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Convair 240, 340 and 440 modifications include airframe, engine and system improvements for greater reliability and better performance (the 340 may be modified to 440 configuration). Installation of additional fuel tanks, auxiliary power units, radar nose, radio, autopilot, new instrumentation, and new electrical, hydraulic and pneumatic systems as well as exterior painting are done by AiResearch specialists meeting all CAA regulations. AiResearch is qualified to perform all Convair Service Bulletins.

Hundreds of other aircraft, including DC-3s, DC-6s, DC-7s, Lodestars and D-18s, have been converted by AiResearch...its more than 150,000 square feet of floor space representing the finest conversion, modification and servicing facilities available.

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fication kits for Model 111 firing sequencers, (PR-58-1365, SA-2 to contract AF 08(606)-2376), $20,669.

Convair-Astronautics Division, General Dynamics Corp., San Diego, Calif., increase in equipment, (PR-58-1388, SA-3 to contract AF-08(606)-2400), $585,152.

Milgo Electronics Corp., Miami, Fla., increase in funds, (PR-58-1243, SA-4 to contract AF 08(606)-1489), $59,411.

Convair Division, General Dynamics Corp., San Diego, Calif., increase in funds, (PR-58-1263, SA-14 to contract AF 08(606)-1013), $23,059.

Westinghouse Electric Corp., East Pittsburgh, Pa., increase in funds, (PR-58-1848, CO no. 10, to contr. AF 08(606)-922), $188,000.

HEADQUARTERS, AFFTC, ARDC, USAF, Edwards AFB, Calif.

Goodyear Aircraft Corp., Akron, Ohio, analyzer, nonlinear and linear, AF 6625-NL, quantity 2, FTKL-58-652, $43,793.

Missiles and Ordnance Systems Department, General Electric Co., Philadelphia, Pa., investigation and evaluation of methods of lubrication for reducing of frictional wear, 1 ea., $98,557.

Research & Advanced Development Division, Avco Manufacturing Corp., Lawrence, Mass., fluorine compatibility test equipment, 1 ea., FTRE-58-53, $58,411.

Aircraft Armaments, Inc., Cockeysville,

Chain Refueling

U. S. Navy North American FJ-4B (top) refuels a McDonnell F3H-2N which in turn refuels a Douglas A4D-2, which similarly services another A4D-2. Unusual refueling maneuver was performed over Patuxent, Md.

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NON-MAGNETIC PROPERTIES . . . "NO-MAG" cable is made from type 305 stainless steel. It remains non-magnetic after severe cold working —in contrast to standard stainless steel aircraft cable which shows a pronounced increase in magnetism after swaging, wire drawing or similar operations.

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Potter, Urquhart, McCreary & O'Breon, Los Angeles, Calif., architect-engineer services for evaluation of the load carrying capacity of Rogers Dry Lake Bed to be used for advance planning of the AFFTC reservation, 1 ea., $38,950.

Edward H. Fickett, A. I. A., Los Angeles, Calif., to survey and design repairs and improvements to title VIII (Wherry) family housing, 1 ea., $35,000.

E. E. Schroder, Lancaster, Calif., modify compressed air facilities in building 1405, 1 ea., (IFB-04-611-58-276), $43,980.

Aeronautics Division, Diancko Engineering Co., Pasadena, Calif., secondary isolation for high speed systems, 1 ea., $37,550.

Permanent Construction Co., Inc., Van Nuys, Calif., construct reinforced concrete check pads, blast fences and taxiways, 1 ea., $57,300.

Electro-Mechanical Research Corp., Sarasota, Fla., electronic parts, AF 6625-NL, 1 ea., $29,865.

WHAT'S NEW

Reports Available:

The following reports may be obtained from the Office of Technical Services, U. S. Department of Commerce, Washington 25, D. C.

Aircraft Collision-Avoidance System Requirements—by P. J. LaRochelle and R. E. Brescia of Naval Research Laboratory. $1.25, 45pp. (PB 131589).

Some Aspects of Crystal Performance in a New Microwave Receiver—by G. E. Hambleton, Evans Signal Laboratory for Signal Corps Engineering Laboratories, U. S. Army. $1.00, 38pp. (PB 131335).

Automatic Data Reduction System — Amplitude — Distribution and Correlation Analyses—by A. Shapiro, Naval Research Laboratory. $.50, 11pp. (PB 131395).

The Airdrag Anemometer—W. A. Von Wald, Jr., Naval Research Laboratory. $.50, 15pp. (PB 131533).

Summary of Development and Evaluation of Insulating Type Refractory Coatings—by S. Sklarew, C. A. Hauck and A. V. Levy, Marquardt Aircraft Co. for Wright Air Development Center, U. S. Air Force. $3.75, 96pp. (PB 121759).

Ceramic Reinforced Alloys and Plated Cermets—by M. T. Curran and others, the New York State College of Ceramics for Wright Air Development Center, U. S. Air Force. $1.25, 49pp. (PB 131188).

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Equipment for Mobile Logistics Support—by U. S. Naval Supply Research and Development Facility. $2.25, 90pp. (PB 131679).

Artificial Earth Satellite—by Yu. A. Pobedonostsev. 23pp. monograph which appeared as an index to a larger Russian publication "Iskusstvennyy Sputnik Zemli." Pub. 1957. $.75. (PB 131756).

High Temperature Hydraulic Fluid Development Status and Engineering Data—by G. Baum, and R. J. Benzing, Wright Air Development Center, U. S. Air Force. $1.25, 43pp. (PB 131512).

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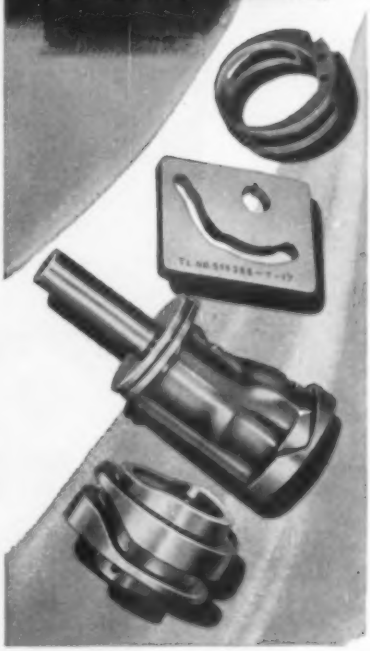

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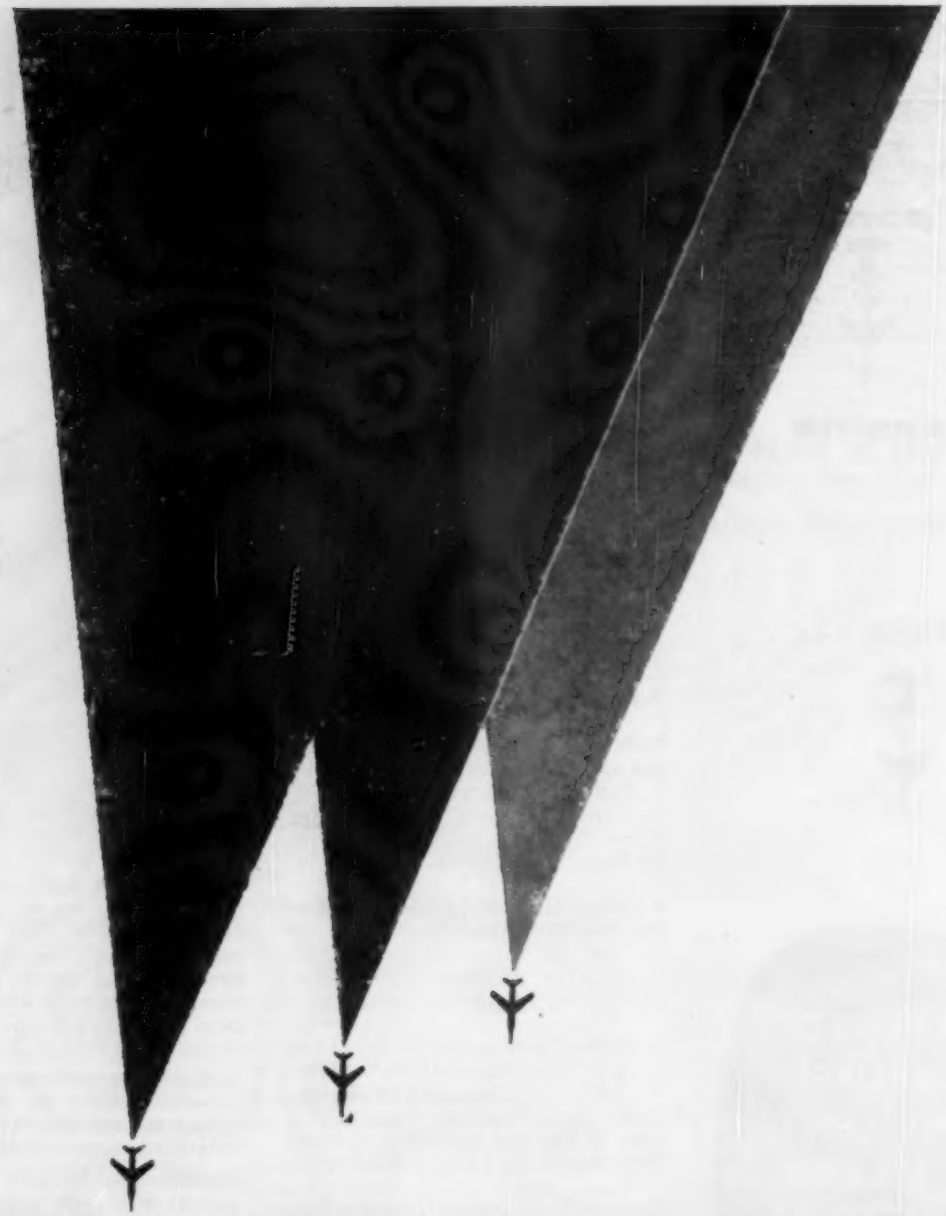

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Outline of **products, facilities and customer service,** booklet, Midway Aircraft Instrument Corp., 185 Berger St., Wood-Ridge, N. J. . . . Description, dimensions and performance charts of **a.c. and d.c. miniature motorized devices,** catalog, Globe Industries, Inc., 1784 Stanley Ave., Dayton 4, Ohio. . . . Illustrated brochure describes **hand tools and accessories** for installing, trimming and gaging blind rivets and lockbolts, Huck Manufacturing Co., 2480 Bellevue Ave., Detroit 7, Mich.

Photo-illustrated description of **high-flow liquid/gaseous oxygen facility** available for missile component tests (Wyle Laboratories' new cryogenics facility, Norco, Calif.), Bulletin No. 3, Wyle Associates, 128 Maryland St., El Segundo, Calif. . . . Illustrated handbook of available **standard and miniature types of clinch nuts** for avionic, electronic and electrical equipment industries, Design Manual 5803, Elastic Stop Nut Corporation of America, 2330 Vauxhall Rd., Union, N. J.

Aircomatic Welding Wire Pocket Guide presents varieties of wire types, wire diameters, packaging data, technical information, etc., form ADC 873, Air Reduction Sales Co., division of Air Reduction Co., Inc., 150 East 42nd St., New York 17, N. Y. . . . Photographs and descriptions of company's **aerodynamics activities, facilities and personnel,** folder, Customer Relations Department, Aerophysics Development Corp., P. O. Box 689, Santa Barbara, Calif.

Listing of more than 100 new items of **terminals and electronic hardware, and description of facilities** for custom design and manufacture, Catalog No. 30, Lerco Electronics, Inc., 501 South Varney St., Burbank, Calif. . . . Operating data, specifications and performance curves of **3-lobe rotary positive industrial blowers and exhausters,** bulletin, Miehle-Dexter Division, 100 Fourth St., Racine, Wisc.

High Speed Zener Switching Circuits, application bulletin Vol. 1, No. 4, gives detailed information on high speed electronic switching for missile computers and ground control computers, Editor, Application Notes, Hoffman Electronics Corp., Semiconductor Division, 930 Pitner Ave., Evanston, Ill. . . . Description, design features and operating data on **Servomanometers,** Bulletin 500, Exactel Instrument Co., 5545 Eva Ave., Los Altos, Calif.

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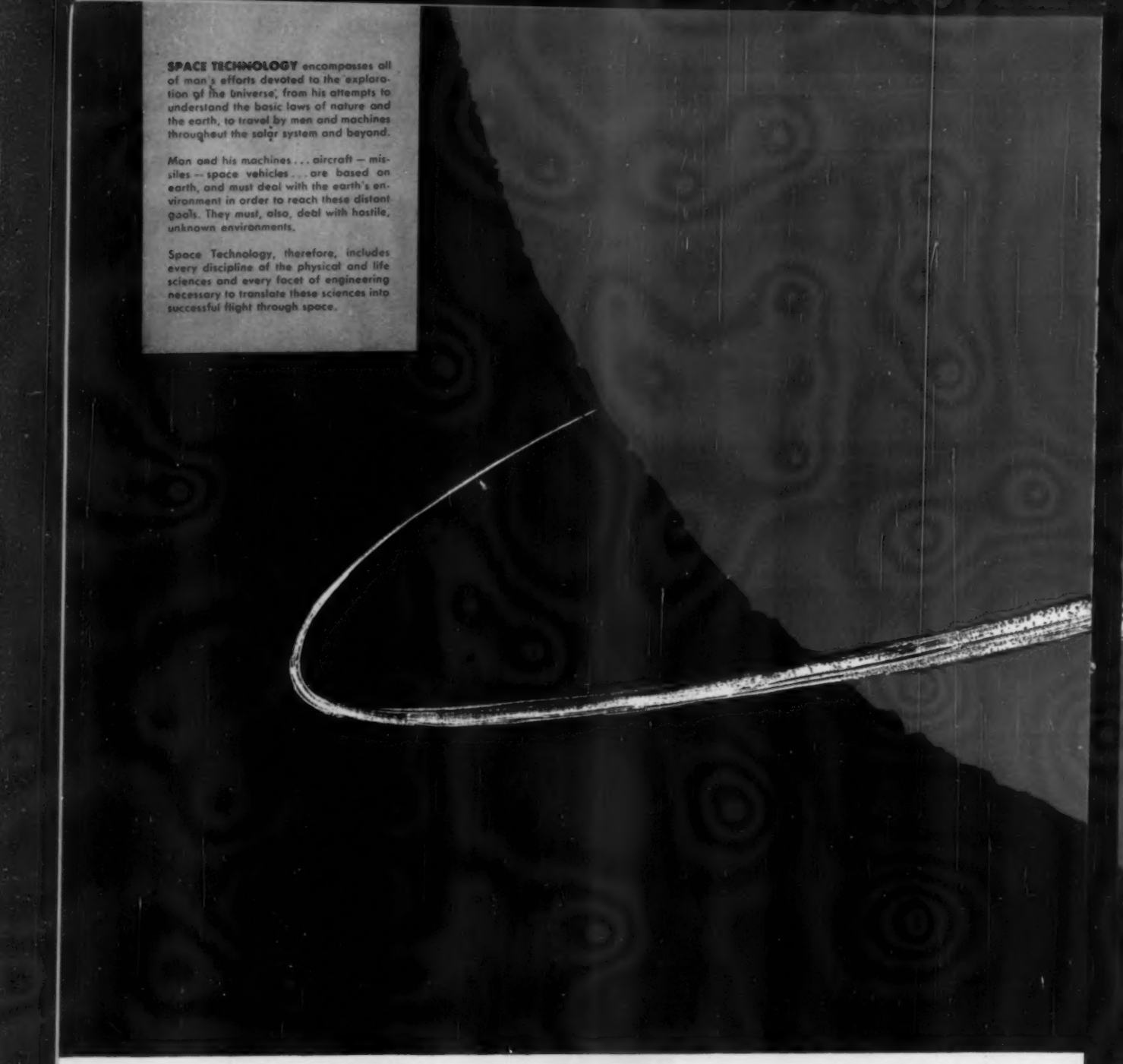
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The pilots said the left turn to final approach was made using a normal bank. It was executed approximately 500 ft. above the ground with an airspeed of about 120 kt. Approach flap was added during the turn. On completion of the turn the aircraft was well aligned with the runway. Neither pilot was able to give the distance to the runway; however, at 450 ft. above the ground the airplane seemed high in consideration of the distance. First Officer Casper said that at this time he intended to ask permission to go around; however, before he asked, Capt. Harpham took control of the airplane. The captain said that he felt he should take control but that he believed he could continue and land without difficulty.

Capt. Harpham testified that the technique he employed in continuing was to immediately close the throttles and apply full landing flap with the right hand. Concurrently he applied back pressure to the yoke with his left hand and slowed the airplane to about 95 kt. He stated that it was his intention to slow the aircraft, then to lower the nose, getting as much descent as possible over the distance and at the same time increase the airspeed to about 110 kt. to assure an adequate airspeed for the flareout and touchdown. Responding to questions, the captain said that his technique resulted in an abnormally steep nose-down attitude and high rate of descent. He stated that without power and in landing configuration he doubted if the airspeed increased for the flareout as he had planned. Consequently, when he began the flareout these factors resulted in the rate of descent continuing with little abatement until the runway was contacted. The captain said that he added some power during flareout but with the runway rapidly approaching this was psychologically hard to do and was the reason he did not add more. The captain stated that in his opinion it was the technique he employed before reaching the flareout position that resulted in the hard landing rather than the flareout timing or use of control in the flareout.

Questioned concerning his training to qualify as captain on the Martin aircraft, Capt. Harpham recalled that it included the "high-altitude approach." This maneuver is one used to descend as quickly as possible over the shortest distance. It would be appropriate during an approach to a runway from a high, close-in position. He said that the proper conduct of this maneuver requires slowing the aircraft to 100-105 kt. in the landing configuration (full landing flap, and gear extended). It then requires the maximum descent obtainable maintaining the airspeed and carrying no less than 15-18 in. of manifold pressure until reaching the flareout position. The captain said that during training this maneuver was demonstrated to him and he had flown it. The captain stated that during the Massena approach he used no power and less airspeed than 100-105 kt., both of which were contrary to the prescribed technique for the maneuver. When asked, however, he added that 100-105 kt. and 15-18 in. of power had not been indicated as being limits to the maneuver.

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CAB Accident Investigation Report:

Faulty Technique Cited in Hard Landing

At 1520[1] on November 14, 1957, Eastern Air Lines Flight 18 made a hard landing at Richards Field, Massena, New York. The two passengers and three crew members were uninjured. The aircraft, a Martin 404, N 492A, received major damage.

HISTORY OF THE FLIGHT

Eastern Air Lines Flight 18 is a scheduled operation serving the carrier's route between New York City and Massena, N. Y., and its intermediate stops at Albany, Plattsburg, and Malone, N. Y. On November 14, at 1245, the flight originated on schedule, its flight crew consisting of Capt. Joseph W. Harpham, First Officer Robert Casper and Flight Attendant Nancy A. Price. The flight followed routine preparation and was in accordance with an IFR (Instrument Flight Rules) flight plan. The general weather conditions over most of the route were forecast to be good.

The flight proceeded through the intermediate stops in a routine manner, with most passengers deplaning at Albany and Plattsburg. Just prior to reaching Malone the instrument flight plan was canceled in good weather conditions. The flight landed at Malone at 1502.

Continuing uneventfully, Flight 18 departed Malone at 1510. The gross takeoff weight of the Martin 404 was 35,977 lb., 8,923 lb. under the maximum allowable. According to the load manifest the load was properly distributed within the center of gravity limitations. The first officer made the takeoff, climbed the aircraft approximately 2,500 ft., and flew it to Massena. Capt. Harpham, from his left seat, supervised the flight and performed the duties of copilot.

At 1516, when about 8 mi. east of Richards Field, Capt. Harpham reported the flight's position, then asked for and received landing information, which included the surface wind as "northeast 5 to 10 kt.," and the active runway 4 (150 ft. wide and 4,000 ft. long). First Officer Casper established a downwind leg at 1,200 ft. to execute a rectangular left-hand pattern for landing on runway 4.

The flight was viewed briefly by ground observers during the pattern before reaching the final landing approach and it seemed entirely normal. As the aircraft drew closer to the threshold it seemed high and thereafter assumed an abnormally steep descent. As it approached the runway surface the aircraft assumed a flareout attitude; however, the rate of descent continued with great force at which time the right powerplant separated from the aircraft. The aircraft rebounded and again contacted with little visible abatement. Consequently, N 492A contacted the runway surface with great force. It then rolled forward and gradually off the runway to the right. Before stopping it crossed a taxiway and the left powerplant fell free, accompanied by a small fire in the engine and the empty nacelle area.

As the aircraft stopped Capt. Harpham shut off the fuel and electrical services and ordered the loading ramp lowered. The passengers and crew quickly evacuated by this exit without difficulty or reported injury.

At 1522, two minutes after the accident, weather conditions were reported as: Ceiling 4,000 ft. broken, 10,000 ft. overcast; visibility 3 mi.; haze; wind northeast 6 kt.

INVESTIGATION

Investigation on the scene revealed that N 492A initially contacted the runway 455 ft. beyond the approach end and 55 ft. inboard of the right edge. The contact was evidenced by prominent marks from the right main tires and indentations in the asphalt surface of the runway made by the right main outboard wheel rim. The tire marks were apparent for the next 36 ft. and were in general alignment with the runway heading. Within the tire marks there were three propeller cuts in the runway made by the right propeller blades. To the left, slightly beyond and parallel to these cuts, were three similar cuts inflicted by the left propeller blades.

Eyewitness observations, crew testimony, and the absence of marks on the runway, revealed the aircraft then rebounded and was airborne for the next 580 ft. During this time the right powerplant separated, fell free, and tumbled to the right side of the runway and stopped about 400 ft. beyond the initial contact. Tire scuff marks and additional wheel indentations marked the second runway contact. Thereafter rubber marks showed the path of the aircraft as it rolled gradually toward the right edge of the runway and overran it 1,350 ft. beyond the approach end. The Martin continued to a stop at a location 169 ft. to the right of runway 4 and 2,350 ft. past the approach end. The left powerplant fell off just before the aircraft stopped.

High inertia forces tore out both powerplants. These forces caused the upper engine support struts to fail in tension and the lower struts in twisting and buckling. Fuel and oil which flowed from broken lines was ignited in the case of the left engine, causing the fire which occurred.

The outer skin and internal structure between fuselage stations 280 and 311 were cut and torn. This damage was inflicted by the No. 3 blade of the right propeller after the propeller struck the ground and the blade was torn from its hub and hurled into the fuselage.

The front wing spar, including the cap and web, failed at station 120. This damage was the result of deceleration forces imposed on the structure during the severe runway contacts. There was no evidence of material weakness.

Damage found in the left engine nacelle area and to the left wing center section structure showed the aircraft had rolled over the left powerplant, with some damage in these areas being the result of strikes by the blades of the left propeller.

Examination showed the landing gear was extended, locked down, and undamaged. The main gear tires remained inflated; however, areas of flattening on the right outboard wheel rim revealed its tire had been subjected to maximum deflection, permitting the wheel to contact the runway. Indentation in the runway surface which matched the flattened areas on the rim showed this maximum tire deflection occurred at both the initial and secondary touchdown points. The nosewheel tire was blown. The landing gear shock struts were in good condition and properly serviced.

The wing flaps were extended equally to the landing setting, 45 deg.; however, they had received major damage, apparently from contacts with the separated powerplants. The left flap hinges at stations 55 and 120 were sheared from the spar.

As a result of the examination, all damage to the aircraft was determined to have resulted from high inertia forces associated with the hard landing and from contacts between the aircraft and the separated powerplants. Both Capt. Harpham and First Officer Casper substantiated this determination by stating that there was no malfunctioning of the aircraft before impact. Describing the severity of the runway contact, Capt. Harpham said it was so hard that he was momentarily stunned.

Wind Conditions

The captain testified that when he reported in range and received landing information, he recalled the prior landings at Plattsburg and Malone were according to a southwest surface wind, contrary to the reported wind at Massena, "northeast 5 to 10 kt." He mentioned this to the first officer. On the downwind leg, however, the captain noted smoke from an industrial plant near the airport which confirmed the Massena wind direction as reported. The in-range checklist was completed and the downwind leg was flown in a normal manner. The aircraft was slowed, after which takeoff flap was extended and the landing gear lowered and checked.

The pilots stated that a left turn to base leg was made about 800 ft. above the ground and at a normal airspeed of about 130 kt. Capt. Harpham said that during and after the turn he noted the presence of an overriding wind which drifted the aircraft somewhat closer to the airport. He added that this wind situation was related as a factual observation and not as a factor in the hard landing. Investigation revealed that a southwest wind did exist which was overriding the northeast surface wind. Velocity of the southwest wind was approximately 20 kt. above 500 ft.

[1] All times herein are eastern standard and are based on the 24-hour clock.

Lines, testified that had Capt. Harpham used no power and less than 100-105 kt. in the high-altitude approach during training, he certainly would have been warned against it. He stated that the company taught the maneuver as it was to be executed and described situations where it would be applicable. He indicated that while limits to the approach technique were probably not specifically stated, the attitude of the aircraft and rate of descent obtained as the maneuver was taught should prompt the pilot not to go beyond this technique. The Chief of Training said that, nevertheless, since this accident and another nearly identical to it, a decision had been made to publish written material warning pilots against a completely power-off approach. This material, he said, would not only be applicable to the operation of the Martin 404 but to all of the carrier's equipment. He said this material would become part of the flight manual for each type aircraft.

It is clearly evident that the principal damage to N 492A was the result of high forces induced by contacting the runway at an excessive descent velocity. It is equally clear that these forces exceeded the design strength of the aircraft structure. Other damage occurred in the sequence of events when the aircraft passed over and contacted the separated powerplants and when the propellers cut and tore the aircraft structure.

The Board concurs with Capt. Harpham that the technique he employed after taking control from the first officer was faulty and precipitated the hard landing. In consideration of his experience and qualifications he should have realized that a considerably steeper nose-down attitude than normal and an abnormally high rate of descent would result from his technique. Knowledge of an approach maintaining 105 kt. and 15-18 in. of power should have indicated to him that an approach resulting from this technique would be undesirable in standard air carrier practice. Further, if Capt. Harpham did not know precisely the approach which would result from this technique, it was unwise to use it.

It is also the Board's view that company training did not fulfill its entire responsibility. The Board realizes that a training program cannot anticipate and cover every possible contingency or situation. Nevertheless, it is vital to formalize the safe operational limits of maneuvers such as the landing approach. In this situation, where the limits of airspeed and power retained were most important, they might well have been included as part of the training on the high-altitude approach. The previous accident which occurred under nearly identical circumstances, together with this one, would seem to emphasize the necessity and wisdom for such inclusion. Thus, the material added to the flight manuals cautioning pilots against a completely power-off approach appears to be essential under the circumstances.

FINDINGS

On the basis of all available evidence the Board finds that:

1. The carrier, the aircraft, and the flight crew were properly certificated.

2. The flight was properly dispatched

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This is the tenth of a series of advertisements dealing with basic facts about alloy steels. Though much of the information is elementary, we believe it will be of interest to many in this field, including men of broad experience who may find it useful to review fundamentals from time to time.

Chromium and Its Effects in Alloy Steels

As previously pointed out in this series, the elements that together make up an alloy steel work both singly and collectively. In a sense they are like the components of a machine, each having its job to do, yet each working with other components to achieve an overall result.

An earlier discussion was devoted to the functions of nickel. In this one we shall outline briefly some of the purposes of chromium, another of the fundamental alloying elements.

Chromium is a versatile agent. Among other things, it fosters depth-hardenability, improves surface resistance to abrasion and wear, and promotes carburization. Of the common alloying elements, chromium ranks near the top in hardenability. This property tends to make high-chromium steels relatively air-hardening; hence it is valuable in applications where, for one reason or another, liquid quenches are undesirable.

Chromium steels are relatively stable at high temperatures and are often used where resistance to heat is important. Moreover, the presence of chromium is a vital factor in helping to retard or prevent corrosion.

The uses of chromium steels are many and varied. Among the more familiar items that often contain chromium are hand tools, gears, springs, turbine wheels, ball and roller bearings, forged shafts and rotors, etc. There are of course numerous others; virtually no list would be all-inclusive.

One of the most useful of the alloys, chromium has been the subject of long study by Bethlehem metallurgists. These technicians have a thorough working knowledge of its effects in various types of analyses. Whenever you have a problem involving chromium steels, or would like to know more about the subject in general, by all means communicate with the Bethlehem staff. Our men will come to your office or plant at any time. You will find them co-operative and helpful.

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(Continued from page 23)

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Warren E. Edwall, Washington, D. C., representative, Airborne Systems Department, Defense Electronic Products, Radio Corporation of America, New York, N. Y.

William M. Gourley, manager-engineering administration, Government and Industrial Division, Philco Corp., Philadelphia, Pa.

Dr. David M. Gardner, project leader-missile propulsion chemicals research, Pennsalt Chemicals Corp., Philadelphia, Pa.

Col. James W. Anderson, Jr., (USAF, ret.) will direct the Magnavox Company's new subsidiary, Magnavox Astro-Physics Laboratory, Inc., Rochester, N. Y.

Wayne Thompson, assistant to the vice president-manufacturing, Horkey-Moore Associates, Torrance, Calif. Also: **Lynn Bly**, assistant chief engineer, and **Earl Schoenlein**, customer relations representative.

Donald Z. Erle, chief engineer-fluid control devices, the Hydrodyne Corp., North Hollywood, Calif. Also: **Richard E. Tisch**, chief engineer, Hydrodyne's Skinner Seal Division.

Robert D. Knies, manager-manufacturing, Commercial Engine Operation, Aircraft Gas Turbine Division, General Electric Co., Cincinnati, Ohio.

Thomas J. Harriman, director of engineering, G. M. Giannini & Co., Inc., Pasadena, Calif.

J. R. Muehlberg, Eastern Hemisphere aviation adviser, London, England, Esso Export Corp., New York, N. Y. **A. B. Cramton** succeeds Mr. Muehlberg as technical services division manager of Esso's aviation department.

W. G. Doran, director of material, Douglas Aircraft Company, Inc., Santa Monica, Calif., succeeding the late D. J. Bosio.

Dr. Charles F. Robinson, chief research physicist, and **Dr. Leland G. Cole**, chief research chemist, Consolidated Electrodynamics Corp., Pasadena, Calif.

John B. Andersen, public relations director, Capital Airlines, Inc.

Emmet S. Iverson, southeastern representative (offices in Huntsville, Ala.) in charge of technical liaison, Aerophysics Development Corp., Santa Barbara, Calif.

Jack H. Blades, director of sales, American Machine & Foundry's Co.'s Government Products Group, Washington, D. C.

Harry Schmidt, engineering consultant, R. Dixon Speas Associates, Flushing, N. Y.

Thomas T. Hill, technical liaison manager, data processing facility of Sylvania Electronic Systems, a division of Sylvania Electric Products, Inc., Needham, Mass. Also: **Frank M. Thomas**, manager-manufacturing organization of the data processing facility.

Harold F. Faught, assistant chief engineer, Aviation Gas Turbine Division, Westinghouse Electric Corp., Kansas City, Mo. **Robert E. Weiler** succeeds Mr. Faught as manager-preliminary design and performance.

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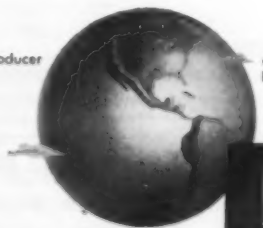

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and conducted in a routine manner to the area of Massena, New York.

3. The first officer operated the aircraft in the traffic pattern.

4. During the turn to the base leg and while on base leg, an overriding wind was allowed to drift the aircraft closer to the airport.

5. From a higher and closer than normal position on final approach, the captain took control of the aircraft and continued the approach.

6. The throttles were closed, landing flap was extended, and the aircraft was slowed to 95 kt.

7. The aircraft descended in an abnormally steep nose-down attitude and at a high rate of descent.

8. The altitude remaining was insufficient for the aircraft in its existing configuration to regain adequate flareout speed.

9. The flareout attitude was accomplished; however, the rate of descent continued with little abatement.

10. The aircraft contacted the runway with great force causing major structural damage.

11. Important limits in the approach technique were not included as part of company pilot training.

12. There was no malfunction or failure of the aircraft prior to the runway contact.

PROBABLE CAUSE

The Board determines that the probable cause of this accident was the captain's incorrect technique during the final approach which resulted in an abnormally steep nose-down attitude and high rate of descent, the latter not being sufficiently arrested before touchdown.

By the Civil Aeronautics Board:

James R. Durfee
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SUPPLEMENTAL DATA

The Civil Aeronautics Board was notified of the accident at 1555 November 14, 1957, through CAA communications. An investigation was immediately initiated according to the provisions of Section 702 (a) (2) of the Civil Aeronautics Act of 1938, as amended. Depositions were ordered and taken in the Federal Building, New York International Airport, Jamaica, New York, on December 19, 1957.

Eastern Air Lines, Inc., is a Delaware corporation with its corporate offices located at New York, New York. The company possesses a currently effective certificate of public convenience and necessity issued by the Civil Aeronautics Board and an air carrier operating certificate issued by the Civil Aeronautics Administration authorizing the carriage of persons, property, and mail over the route of the accident.

Capt. Joseph W. Harpham, age 39, was employed by Colonial Airlines, (later merged with Eastern Air Lines) on March 27, 1946. He was promoted to captain July 1, 1955. Capt. Harpham holds a currently valid airline transport rating and type ratings on DC-3 and DC-4, Constellation, and Martin 202 and 404 aircraft. At the time of the accident he had accumulated 11,870 flying hours, of which 535 were in the Martin 404. Capt. Harpham completed transition training in the 404 on September 13, 1956. His latest line and instrument checks were satisfactorily accomplished on July 24, 1957, and August 9, 1957, respectively. His latest physical examination was satisfactory, without waivers, on July 5, 1957.

Pilot Robert Casper, age 31, was employed by the company on May 6, 1957. He holds a valid airman certificate with commercial and instrument ratings. He was trained by Eastern on the Martin 404 during May and June 1957. Pilot Casper had accumulated 738 flying hours at the time of the accident, of which 155 were in the equipment involved. His latest physical examination was current and satisfactory, without waivers.

Flight Attendant Nancy A. Price, age 21, was employed by the company in July, 1957. She completed flight attendant training on July 20, which included appropriate training in evacuation and emergency procedures for the aircraft utilized by the carrier.

N 492A, a Martin 404, bore serial number 14240 and was manufactured November 26, 1952. It had a total operational time of 15,617 hr. at the time of the accident. It had flown 21 hr. since the last periodic service inspection. During these hours operation of the aircraft was reported normal and records showed all trip inspections were completed. N 492A was equipped with Pratt and Whitney R-2800-CB-3 engines and Hamilton Standard propellers, hub model 43E60-9, blade model 6895A-12.

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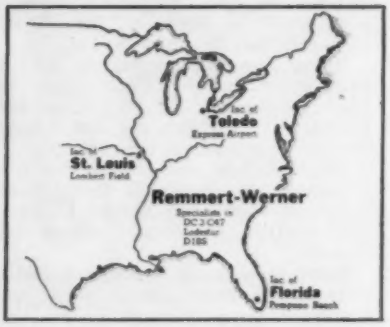

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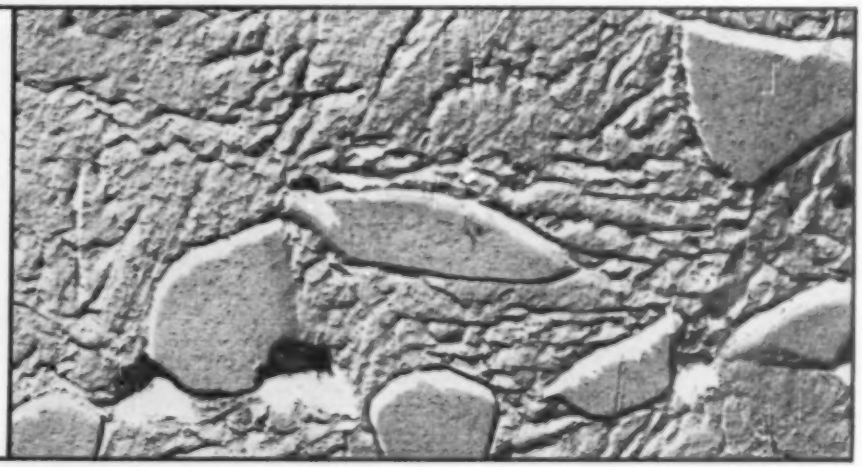

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LETTERS

Jetliner Safety

I have been looking forward with pleasure to my first trip as a paying passenger in one of the three American four-engined jet transports, but now I am filled with trepidation. After hearing Lockheed's Kelly Johnson tell of 10 years' effort on configuration studies and seeing a movie on the crash fire potentialities of the low wing, underslung nacelle arrangement, I believe there is cause for alarm. When belly landings of transport aircraft have become commonplace and with landing gears less than 100% perfect, an airplane that must land on hot, spinning engines is certainly dangerous. An engine breaking up and shooting hot projectiles through adjacent wing tanks, even if filled with kerosene, is not a safe situation. The recent crash of a Boeing KC-135 is an example of complete disintegration or explosion on ground contact, and only 15 lives were lost. What will happen when transports have a load of 150 passengers? With all the much vaunted CAA regulations for air safety, I wonder if they have goofed on a basic and simple thing like an engine layout that is inherently a hazard.

ROBERT M. BERNS
Van Nuys, Calif.

Swivel Necking

In your July 7 issue, p. 110, Mr. Morton stated, "If we all file and fly IFR above 10,000 ft. and on airways only, those who are VFR can run into those who are VFR."

Mr. Morton, if you would stop reading "funny books" when you are supposed to be transporting passengers safely from point to point, I think that we could stop most of these "see and be seen" arguments and mid-air collisions. It would appear, from your letter, that everyone is wrong except the airline pilot. When flying on an IFR flight plan and in VFR conditions, you should look out the window the aircraft manufacturer so conveniently placed close to your seat.

Instead, you are very eager to place on the shoulders of others the responsibility YOUR union compels the company for which you fly to pay you so highly. Look out the window the next time you fly and you will soon know what I mean.

I had the pleasure of flying for two and one-half years (of my 10 years of Naval flying) as an instructor in the Navy's flight training program. Our visibility was restricted because of our position in the rear seat of the aircraft, yet in these years, we had no mid-air collisions. During each day of flight training (five and sometimes six days a week) there were as many as 500 aircraft within an area of 50 sq. mi., and yet we missed each other. This was not luck, but the knowledge that these conditions were ideal for mid-air collisions. We had a word for keeping an eye out for other aircraft—"swivel necking"—and it worked.

You get paid highly for the job you are doing—please, for the sake of anyone I may know who may someday fly in your ship, take the responsibility that is yours and begin to earn that salary you get, and not try to push the blame on someone else. If you will read the CAA regulations, you will see that when flying on an IFR flight plan, in VFR conditions, you too must (yes, put down that book you were reading) observe all the rules that apply to flight conditions under VFR flight rules.

I guess the ideal solution is to build our own iron curtain five miles to either side of the center line of our airways. No doubt, this would help our present unemployment problem in the steel industry and cure the recession.

NAVY LIEUTENANT
Oxford, Miss.

Aviation Week welcomes the opinions of its readers on the issues raised in the magazine's editorial columns. Address letters to the Editor, Aviation Week, 330 W. 42nd St., New York 36, N. Y. Try to keep letters under 500 words and give a genuine identification. We will not print anonymous letters, but names of writers will be withheld on request.

Revamp Control

I am an avid reader of your weekly editorials in AVIATION WEEK and, consequently, know of your crusade for more stringent and modern air traffic control.

Following is the text of a letter written to my cognizant U. S. senator and congressman in the hope that it will add some fuel to the fire. I thought you would be happy to see that some of us are at last going to back you.

"Due to the recent catastrophies which have occurred over our airlanes in the past few months, I feel it a necessity to write this belated letter.

"As a frequent traveller for both business and pleasure aboard our airlines, it is naturally with a deep personal concern that I have decided to add my name to the obviously ever-increasing lists of protests being received in our nation's capital. For five years now the CAA and CAB have warned the American people and branches of the government that more frequent mid-air collisions will be imminent unless our air traffic control system is revamped on a crash basis. These prophesies were backed up by many aviation periodicals, organizations, clubs, and newspapers. Mr. Robert Hotz of AVIATION WEEK has been one of the more forceful crusaders, and for many years has brought this dangerous situation to the attention of the public. The majority of congressmen and senators have greeted these warnings with the typical apathy so apparent over non-vote-potential problems. I, for one, should have written this letter four or five years ago and feel my guilt is shared with many other persons in this country.

"It is now obvious that the warnings supplied by aviation experts were accurate and that there is a real material need for modernization and single agency control of *all* aircraft now flying in the domestic United States today. In the very near future it will become a necessity to extend this type of control over the airways of the entire free world.

The problem has become so acute that I wish to enter my plea for immediate and decisive action. With the hundreds of lives lost in the past two years due to our antiquated air traffic control, I certainly think the majority of our senators and congressmen at least would be shamed into action, but I have felt this many times before and no results were forthcoming.

"I beg of you and the United States Congress to implement immediately and decisively a workable single agency control of all military and civilian aircraft over the domestic United States."

J. M. JARBOE, JR.
Great Neck, N. Y.

Historic Photos

In the April 21 issue, p. 166, Mr. Warren Bodie asks the question, "Shall we encapsulate the heretics?" Insofar as the preservation of aviation historical data, my reply is affirmative. This wanton destruction is inexcusable regardless of the objectives it was supposed to accomplish. It is presumed that the authorities at Wright-Patterson Air Force Base will provide adequate facilities to preserve the remaining negatives now on file.

To support Mr. Warren Bodie's contention that negatives on nitrate film are not harmful to health or the safety of the base, this writer has received photographs from the U. S. Naval Photographic Laboratory made from original negatives as old as 60 years back. Negatives made during 1917, therefore, should not deteriorate in 40 years.

It should also be noted that further investigation also reveals that duly accredited facilities in the Air Force Central Museum made a determined effort to obtain the custody of these negatives for the use of historians when it was known that the destruction was a matter of official policy. This facility was overruled, regardless of the fact that this facility is charged with the preservation of historical USAF data and memorabilia.

It would seem that the authorities who overrule accredited agencies are certainly working to the disadvantage of the taxpayer who may be interested in procurement of this data at the stated price. Certainly the maintenance of this data in the accredited agency would not seriously impair the efficiency of the USAF, so the claims of economy and safety are somewhat ridiculous.

Having purchased enlargements of the 35 mm. microfilm, may I state that these are of sub-standard quality, they are poorly printed, they are indistinct as to detail, and they are poor copies of good 8 x 10 nitrate film negatives. Thus the good people at Wright-Patterson AFB have not furthered our national heritage of aviation history. They apparently have forgotten that Gen. Henry H. Arnold had the foresight to establish museum facilities for the USAF, and in an orgasm of irresponsible action destroyed much that the late General had saved for future generations.

WILLIS L. NYE
Hayward, Calif.

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